ETHYL ALCOHOL

Table 6.19: Physical Properties of Anhydrous Ethyl Alcohol *(31)*

Acidity as acetic acid	0.0015% by wt. max.
Boiling point at 760 mm Hg	78.32°C
dt/dp at 760 mm Hg	0.0334°C/mm Hg
Coefficient of cubical expansion	0.00060 per 1°F
Color, Pt-Co scale	10 max.
Critical pressure	63.1 atm
Critical temperature	243.1°C
Density at 25°C	0.7851 g/ml
Dielectric constant at 20°C	25.7
Dipole moment, $\mu \times 10^{18}$	1.70 μ
Electrical conductivity at 25°C	1.35×10^{-9} ohm^{-1} cm^{-1}
Explosive range	3.28 - 19%
Fire hazard	Dangerous when exposed to heat or flame
Flash point, Tag open cup	61°F
Free energy of formation, $\Delta F°$ at 25°C	-40.2 kcal/mole
Freezing point	-114.1°C
Heat capacity, Cp, Liquid at 25°C	0.581 cal/g
Cp, Vapor, 90°C,1 atm	0.406 cal/(g) (°C)
Cv, Vapor, 90°C,1 atm	0.359 cal/(g) (°C)
Heat of combustion	328 kcal/mole
Heat of formation, Liquid, ΔH at 25°C	-64.7 kcal/mole
Heat of solution in Water at 13°C	2.54 kcal/mole solute
Heat of solution of Water in Ethyl Alcohol, mole fraction of Water	
0.640 at 77°C	-0.018
0.843 at 79.2°C	-0.038
Latent heat of fusion	24.9 cal/g
Latent heat of vaporization at 78.3°C	204.3 cal/g
MAC	1000 ppm in air
Melting point	-114.4°C
Molecular weight	46.07
Non-volatile matter	Not more than 0.0025 gram when 100 ml are evaporated and heated to constant weight at 100°C to 110°C
Reducing substances	At least 25 minutes permanganate time at 15°C
Refractive index at 25°C, n_D	1.3596
Specific gravity at 15.56°C (60/60°F)	0.7937
Specific heat at 20°C	0.61 cal/g
Specific tension at 25°C	22.1 dynes/cm
Thermal conductivity, k, at 68°F	0.105 (Btu) (ft) (sq ft) (°F)
Toxicity	Moderately toxic by ingestion and inhalation
Vapor pressure at 20°C	44.0 mm Hg
Viscosity at 20°C	1.22 centipoises
Weight per gallon at 20°C	6.61 lbs

Table 6.20: Physical Properties of 95% Ethanol *(31)*

Acidity as acetic acid	0.0025 g/100 ml, max.
Color, Pt-Co scale	10 max.
Distillation range at 760 mm Hg	77°C - 80°C
Non-volatile matter	Not more than 0.0025 gram when 100 ml are evaporated and heated to constant weight at 100°C to 110°C
Permanganate time	30 minutes, min.
Reducing substances	At least 25 minutes permanganate time at 15°C
Relative evaporation rate, n-Butyl Acetate = 100	230
Specific gravity at 15.56 (60/60°F)	0.8160
Weight per gallon at 20°C	6.76 lbs

Table 6.21: Properties and Specifications of Ethyl Alcohol *(30)*

Specifications

	Units	190°	200°	Test Method
Ethyl Alcohol, minimum strength	vol %	95	99.9	IRS Gauging Manual
Acidity as Acetic Acid, maximum	g/100 ml	0.0025	0.0025	ASTM D 1613
Non-Volatile Matter, maximum	g/100 ml	0.0025	0.0025	ASTM D 1353
Permanganate Time, minimum	minutes	50	30	Quantum test
Specific Gravity @ 60°F (15.56°C), maximum		0.816	0.794	ASTM D 891
Color, maximum	Pt-Co	10	10	ASTM D 1209
Odor		Free from foreign odors		Organoleptic

Typical Properties

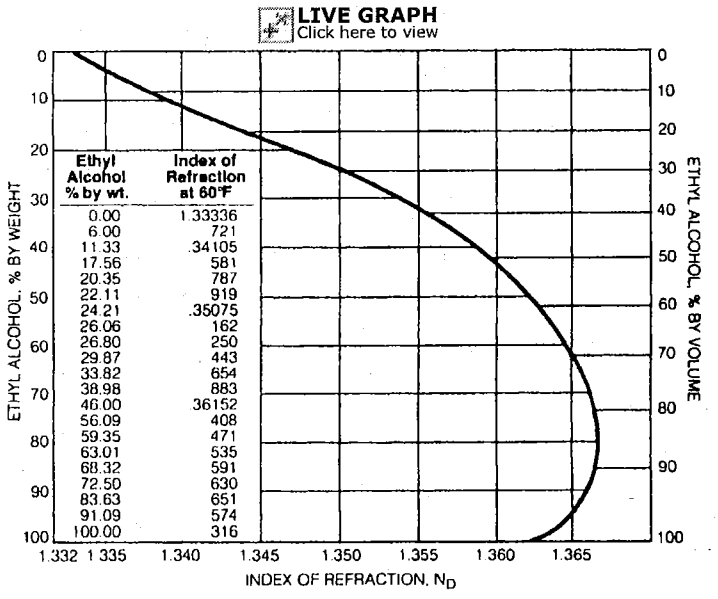
	Units	190°	200°
Boiling Point	°C	78.3	78.4
	°F	172.9	173.1
Coefficient of Expansion			
Per °C		0.0011	0.0011
Per °F		0.00062	0.00062
Flash Point			
ASTM D 1310	°C	21	18
(Tag Open Cup)	°F	69	65
ASTM D 56	°C	17	14
(Tag Closed Cup)	°F	62	57
Weight per Gallon @ 60 °F (15.56 °C)	lbs	6.794	6.610
Water Solubility		soluble in all proportions	

Table 6.22: Conversion Table—Weight and Volume Percent of Ethyl Alcohol in Ethyl Alcohol–Water Mixtures *(30)*

% Alcohol By Volume at 60°F	% to be Converted	% Alcohol By Weight	% Alcohol By Volume at 60F	% to be Converted	% Alcohol By Weight	% Alcohol By Volume at 60°F	% to be Converted	% Alcohol By Weight	% Alcohol By Volume at 60°F	% to be Converted	% Alcohol By Weight
1.257	1	0.795	31.555	26	21.285	58.844	51	43.428	82.121	76	68.982
2.510	2	1.593	32.719	27	22.127	59.852	52	44.374	82.967	77	70.102
3.758	3	2.392	33.879	28	22.973	60.854	53	45.326	83.805	78	71.234
5.002	4	3.194	35.033	29	23.820	61.850	54	46.283	84.636	79	72.375
6.243	5	3.998	36.181	30	24.670	62.837	55	47.245	85.459	80	73.526
7.479	6	4.804	37.323	31	25.524	63.820	56	48.214	86.275	81	74.686
8.712	7	5.612	38.459	32	26.382	64.798	57	49.187	87.083	82	75.858
9.943	8	6.422	39.590	33	27.242	65.768	58	50.167	87.885	83	77.039
11.169	9	7.234	40.716	34	28.104	66.732	59	51.154	88.678	84	78.233
12.393	10	8.047	41.832	35	28.971	67.690	60	52.147	89.464	85	79.441
13.613	11	8.862	42.944	36	29.842	68.641	61	53.146	90.240	86	80.662
14.832	12	9.679	44.050	37	30.717	69.586	62	54.152	91.008	87	81.897
16.047	13	10.497	45.149	38	31.596	70.523	63	55.165	91.766	88	83.144
17.259	14	11.317	46.242	39	32.478	71.455	64	56.184	92.517	89	84.408
18.469	15	12.138	47.328	40	33.364	72.380	65	57.208	93.254	90	85.689
19.676	16	12.961	48.407	41	34.254	73.299	66	58.241	93.982	91	86.989
20.880	17	13.786	49.480	42	35.150	74.211	67	59.279	94.700	92	88.310
22.081	18	14.612	50.545	43	36.050	75.117	68	60.325	95.407	93	89.652
23.278	19	15.440	51.605	44	36.955	76.016	69	61.379	96.103	94	91.025
24.472	20	16.269	52.658	45	37.865	76.909	70	62.441	96.787	95	92.423
25.662	21	17.100	53.705	46	38.778	77.794	71	63.511	97.459	96	93.851
26.849	22	17.933	54.746	47	39.697	78.672	72	64.588	98.117	97	95.315
28.032	23	18.768	55.780	48	40.622	79.544	73	65.674	98.759	98	96.820
29.210	24	19.604	56.808	49	41.551	80.410	74	66.768	99.386	99	98.381
30.388	25	20.443	57.830	50	42.487	81.269	75	67.870	100.000	100	100.000

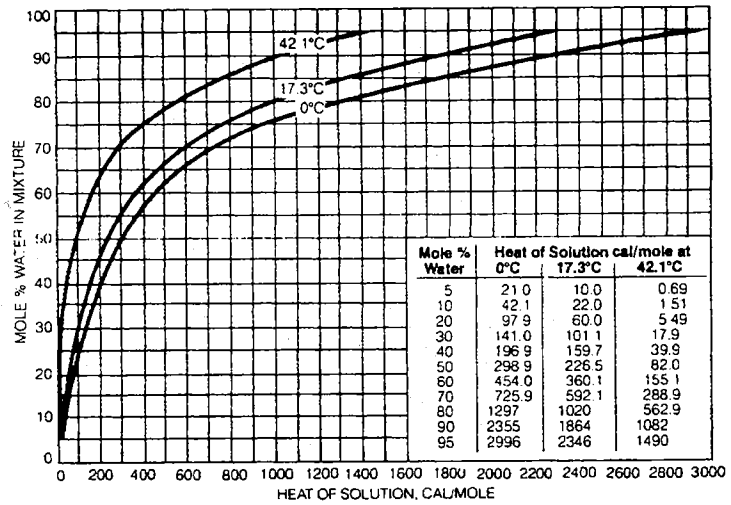
Values from Tables 5 and 6, Bureau of Standards Circular No. 19

Table 6.23: Index of Refraction of Ethyl Alcohol–Water Mixtures at 60°F *(30)*



Data from International Critical Tables

Table 6.24: Heat of Solution of Ethyl Alcohol in Water *(30)*



Mole % Water	Heat of Solution cal/mole at 0°C	17.3°C	42.1°C
5	21.0	10.0	0.69
10	42.1	22.0	1.51
20	97.9	60.0	5.49
30	141.0	101.1	17.9
40	196.9	159.7	39.9
50	298.9	226.5	82.0
60	454.0	360.1	155.1
70	725.9	592.1	288.9
80	1297	1020	562.9
90	2355	1864	1082
95	2996	2346	1490

Data from International Critical Tables
BTU/lb mole = 1.8 cal/g mole

LIVE GRAPH
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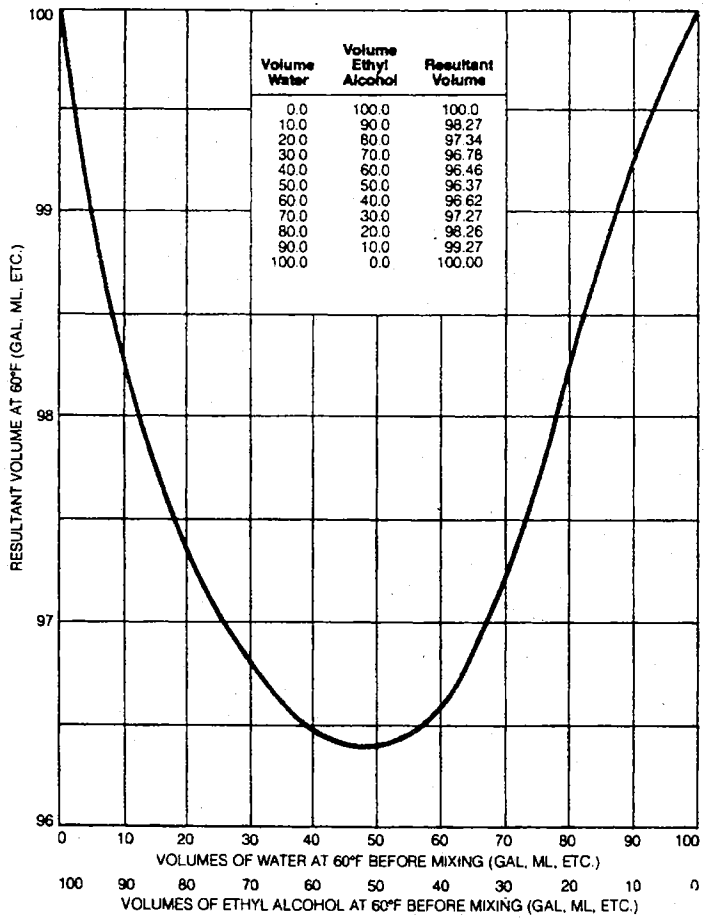
Table 6.25: Resultant Volume When Ethyl Alcohol and Water are Mixed *(30)*



Volume Water	Volume Ethyl Alcohol	Resultant Volume
0.0	100.0	100.0
10.0	90.0	98.27
20.0	80.0	97.34
30.0	70.0	96.78
40.0	60.0	96.46
50.0	50.0	96.37
60.0	40.0	96.62
70.0	30.0	97.27
80.0	20.0	98.26
90.0	10.0	99.27
100.0	0.0	100.00

Ibert Mellan, 'Industrial Solvents Handbook', 2nd Edition, Noyes Data Corporation (1977)

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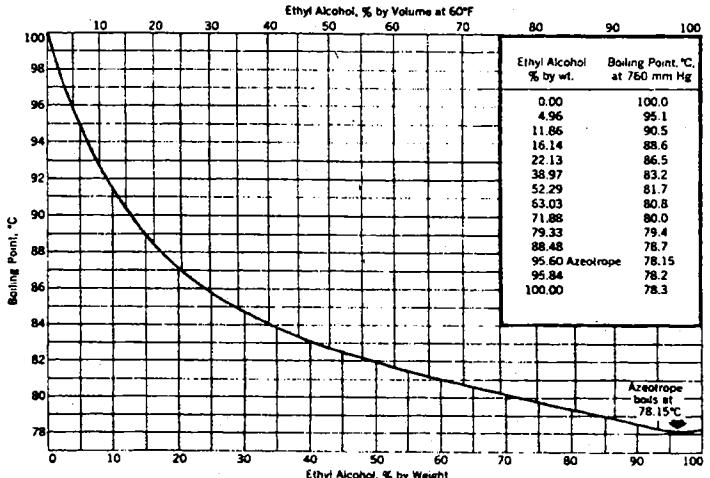
Table 6.26: Boiling Points of Ethyl Alcohol–Water Solutions *(34)*



Ethyl Alcohol % by wt.	Boiling Point, °C, at 760 mm Hg
0.00	100.0
4.96	95.1
11.86	90.5
16.14	88.6
22.13	86.5
38.97	83.2
52.29	81.7
63.03	80.8
71.88	80.0
79.33	79.4
88.48	78.7
95.60 Azeotrope	78.15
95.84	78.2
100.00	78.3

Calculated from mole per cent data given in International Critical Tables

LIVE GRAPH
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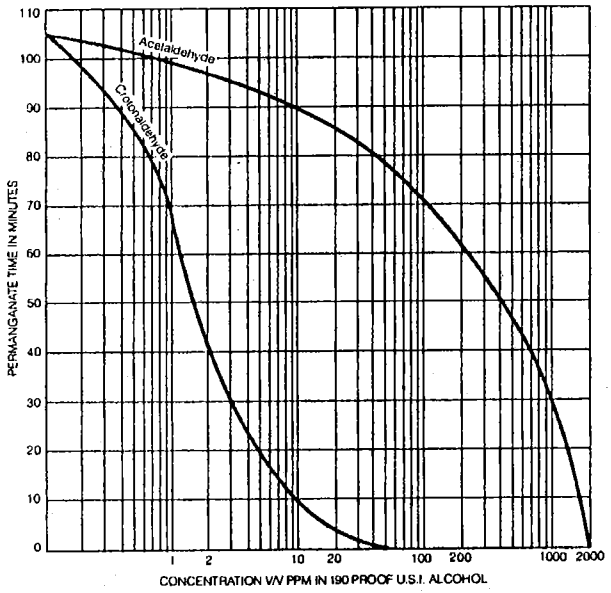
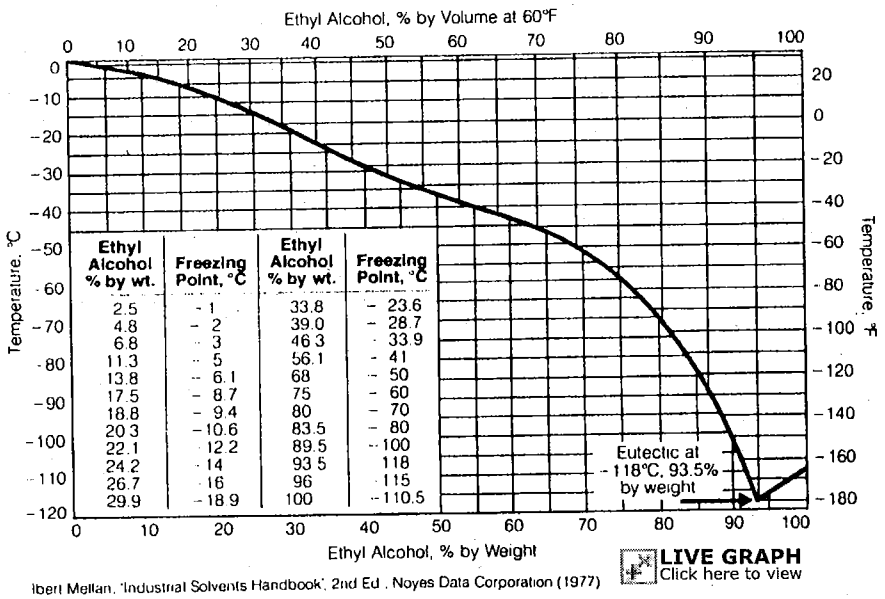
Table 6.27: Permanganate Time Test *(30)*



Ref. U S. Industrial Chemicals Company, Tuscola, IL.

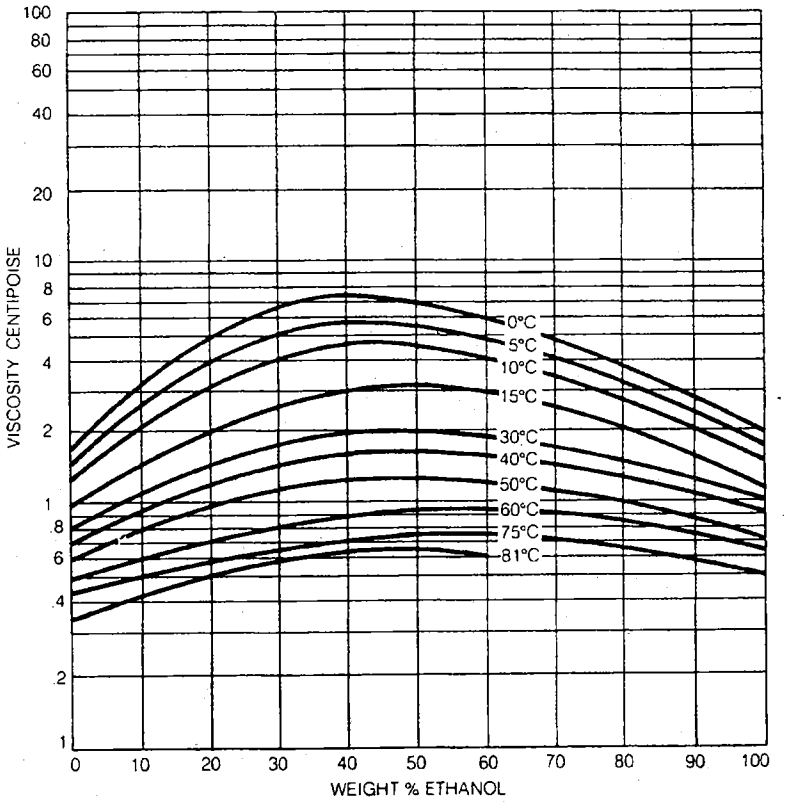
Table 6.28: Freezing Points of Ethyl Alcohol–Water Mixtures *(30)*



Ethyl Alcohol % by wt.	Freezing Point, °C	Ethyl Alcohol % by wt.	Freezing Point, °C
2.5	- 1	33.8	- 23.6
4.8	- 2	39.0	- 28.7
6.8	- 3	46.3	- 33.9
11.3	- 5	56.1	- 41
13.8	- 6.1	68	- 50
17.5	- 8.7	75	- 60
18.8	- 9.4	80	- 70
20.3	-10.6	83.5	- 80
22.1	-12.2	89.5	-100
24.2	-14	93.5	118
26.7	-16	96	-115
29.9	-18.9	100	-110.5

Ibert Mellan, 'Industrial Solvents Handbook', 2nd Ed., Noyes Data Corporation (1977)

Table 6.29: Viscosity of Ethyl Alcohol–Water Mixtures *(30)*



National Bureau of Standards Bulletin, 14 (1918), 59
U S Industrial Chemical Company, Tuscola, Illinois

LIVE GRAPH
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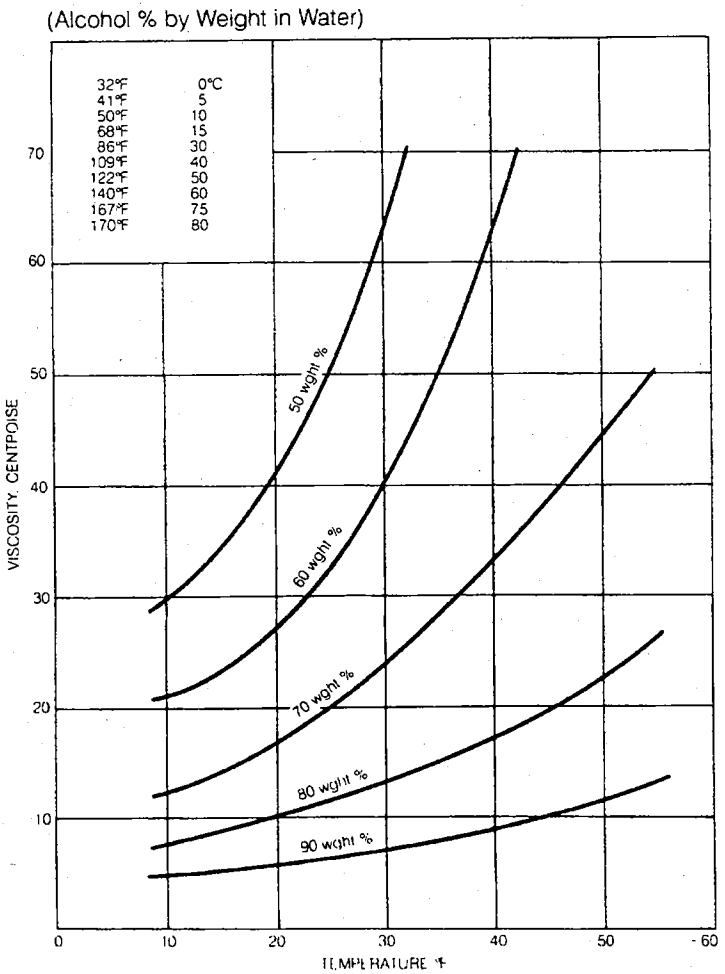

LIVE GRAPH
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Table 6.30: Flash Point of Aqueous Ethyl Alcohol Solutions °C and °F vs Vol % Ethanol *(30)*

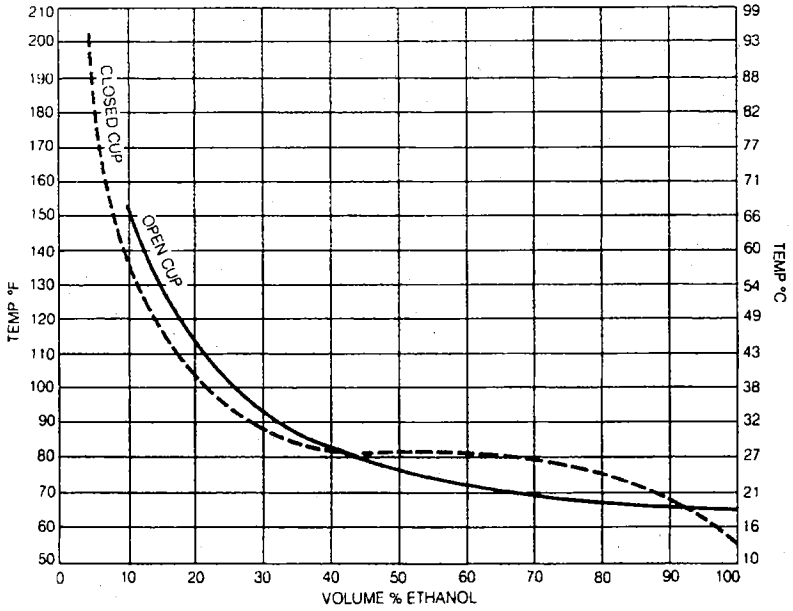

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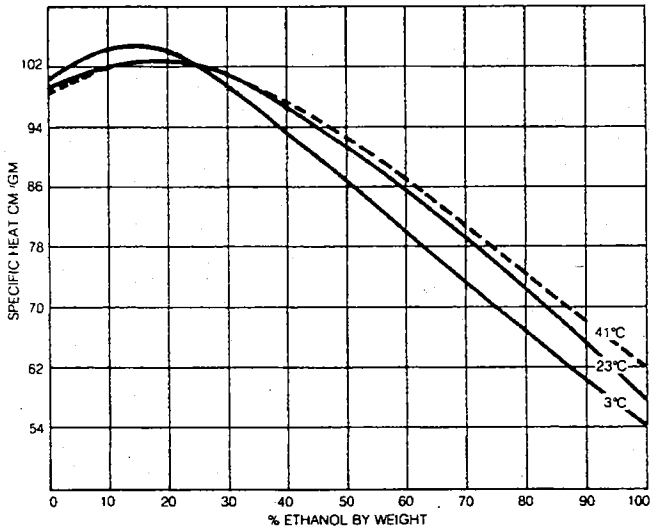
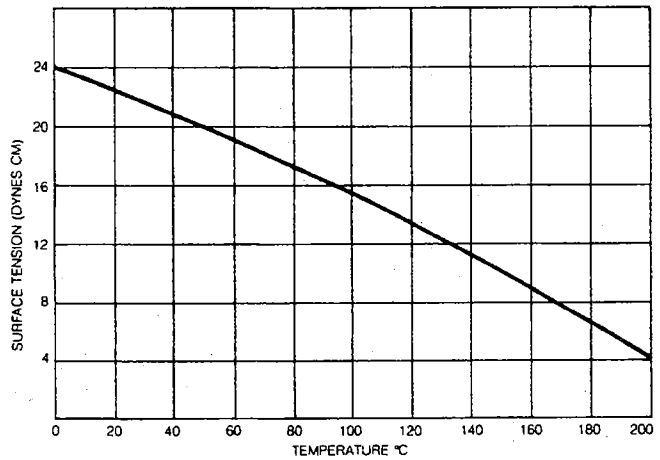
Table 6.31: Specific Heat of Aqueous Solutions of Ethanol *(30)*



Ibert Mellan, 'Industrial Solvents', 2nd Edition, Reinhold Publishing Corp. (1950)

Table 6.32: Surface Tension of Pure Ethanol at Various Temperatures *(30)*



Ibert Mellan, 'Industrial Solvents', 2nd Edition, Reinhold Publishing Corp. (1950)

LIVE GRAPH
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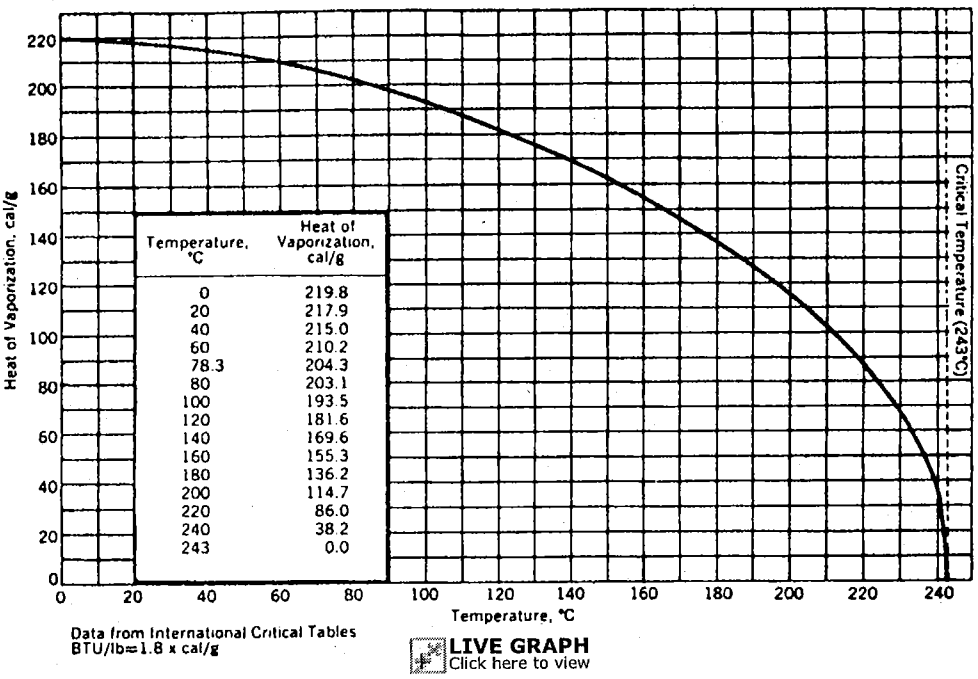
Table 6.33: Latent Heat of Vaporization of Ethyl Alcohol *(34)*



Temperature, °C	Heat of Vaporization, cal/g
0	219.8
20	217.9
40	215.0
60	210.2
78.3	204.3
80	203.1
100	193.5
120	181.6
140	169.6
160	155.3
180	136.2
200	114.7
220	86.0
240	38.2
243	0.0

Table 6.34: Heat Capacity of Ethyl Alcohol at Various Temperatures *(30)*

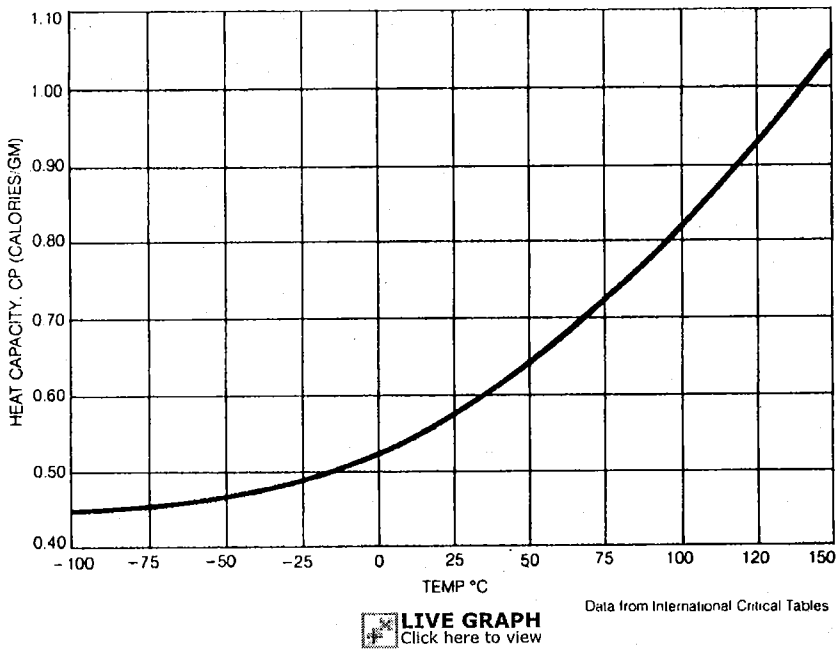


Table 6.35: Volumetric Equivalents *(30)*

The following table will be helpful in the preparation of reports showing disposition of 190 proof and anhydrous (200 proof) tax-free and specially denatured alcohol.

Fluid Ounces	Milliliters	Wine Gallons	Proof Gallons	
			190 proof	200 proof
1	30.	0.008	0.015	0.016
2	59.	.016	.030	.031
3	89.	.023	.045	.047
4	118.	.031	.059	.062
5	148.	.039	.074	.078
6	177.	.047	.088	.094
7	207.	.055	.103	.109
8	237.	.063	.119	.125
9	266.	.070	.134	.140
10	296.	.078	.149	.156
11	325.	.086	.164	.172
12	355.	.094	.179	.187
13	385.	.102	.194	.203
14	414.	.109	.209	.218
15	444.	.117	.224	.234
16 (1 pint)	473.	.125	.238	.250
32 (1 quart)	946.	250	.475	.500
64 (2 quarts)	1892	.500	.950	1.000
96	2839	.750	1.425	1.500
128 (1 U.S. gallon)	3785	1.000	1.900	2.000
		5.000	9.500	10.000
		30.000	57.000	60.000
		54.000	102.600	108.000
		55.000	104.500	110.000

Table 6.36: Ethyl Alcohol-Water Mixtures *(30)*

Corresponding values for proof, parts by vo ume of water and alcohol, weight % alcohol and specific gravity in air.

U.S. PROOF degrees at 60°F	PARTS BY VOLUME* OF		WEIGHT % ETHYL ALCOHOL	SPECIFIC GRAVITY		
	WATER	ETHYL ALCOHOL		at 60°/60°F (15.56°/15.56°C)	at 68°/68°F (20°/20°C)	at 77°/77°F (25°/25°C)
0	100.00	0.0	0.00	1.0000	1.0000	1.0000
1	99.53	0.5	0.40	.9992	.9992	.9992
2	99.06	1.0	0.80	.9985	.9985	.9985
3	98.58	1.5	1.19	.9978	.9978	.9978
4	98.12	2.0	1.59	.9970	.9970	.9970
5	97.65	2.5	1.99	.9963	.9963	.9963

*The parts by volume of water and the parts by volume of ethyl alcohol do not add to unity (100) at any one proof reading, because of the shrinkage in volume which occurs when ethyl alcohol and water are mixed. The *parts by volume* of ethyl alcohol are the same as *percent by volume* of ethyl alcohol used to determine proof for tax purposes. Ethyl alcohol proof, by legal definition, is twice the percent by volume.

(continued)

Table 6.36: (continued)

U.S. PROOF degrees at 60°F	PARTS BY VOLUME* OF		WEIGHT % ETHYL ALCOHOL	SPECIFIC GRAVITY		
	WATER	ETHYL ALCOHOL		at 60°/60°F (15.56°/15.56°C)	at 68°/68°F (20°/20°C)	at 77°/77°F (25°/25°C)
6	97.18	3.0	2.39	.9956	.9956	.9956
7	96.71	3.5	2.79	.9949	.9949	.9948
8	96.24	4.0	3.19	.9942	.9942	.9941
9	95.78	4.5	3.60	.9935	.9935	.9934
10	95.31	5.0	4.00	.9928	.9928	.9927
11	94.85	5.5	4.40	.9921	.9921	.9921
12	94.39	6.0	4.80	.9915	.9914	.9914
13	93.93	6.5	5.21	.9908	.9908	.9907
14	93.46	7.0	5.61	.9902	.9902	.9901
15	93.01	7.5	6.02	.9896	.9895	.9894
16	92.55	8.0	6.42	.9890	.9889	.9888
17	92.09	8.5	6.83	.9884	.9883	.9882
18	91.63	9.0	7.23	.9878	.9876	.9875
19	91.18	9.5	7.64	.9872	.9870	.9869
20	90.72	10.0	8.05	.9866	.9864	.9863
21	90.27	10.5	8.46	.9860	.9858	.9856
22	89.81	11.0	8.86	.9854	.9852	.9850
23	89.36	11.5	9.27	.9848	.9846	.9844
24	88.90	12.0	9.68	.9843	.9840	.9838
25	88.45	12.5	10.09	.9837	.9835	.9832
26	88.00	13.0	10.50	.9832	.9829	.9826
27	87.55	13.5	10.91	.9826	.9823	.9820
28	87.10	14.0	11.32	.9821	.9817	.9814
29	86.65	14.5	11.73	.9816	.9812	.9808
30	86.20	15.0	12.14	.9810	.9806	.9802
31	85.75	15.5	12.55	.9805	.9801	.9796
32	85.30	16.0	12.96	.9800	.9797	.9790
33	84.85	16.5	13.37	.9794	.9790	.9784
34	84.40	17.0	13.79	.9789	.9784	.9778
35	83.95	17.5	14.20	.9784	.9779	.9773
36	83.50	18.0	14.61	.9779	.9773	.9767
37	83.06	18.5	15.03	.9774	.9768	.9761
38	82.61	19.0	15.44	.9769	.9763	.9756
39	82.16	19.5	15.85	.9764	.9757	.9750
40	81.72	20.0	16.27	.9759	.9752	.9744
41	81.27	20.5	16.68	.9754	.9747	.9739
42	80.82	21.0	17.10	.9749	.9741	.9733
43	80.38	21.5	17.52	.9744	.9736	.9727
44	79.93	22.0	17.93	.9739	.9731	.9721

*The parts by volume of water and the parts by volume of ethyl alcohol do not add to unity (100) at any one proof reading, because of the shrinkage in volume which occurs when ethyl alcohol and water are mixed. The *parts by volume* of ethyl alcohol are the same as *percent by volume* of ethyl alcohol used to determine proof for tax purposes. Ethyl alcohol proof, by legal definition, is twice the percent by volume.

(continued)

Table 6.36: (continued)

U.S. PROOF degrees at 60°F	PARTS BY VOLUME* OF		WEIGHT % ETHYL ALCOHOL	SPECIFIC GRAVITY		
	WATER	ETHYL ALCOHOL		at 60°/60°F (15.56°/15.56°C)	at 68°/68°F (20°/20°C)	at 77°/77°F (25°/25°C)
45	79.48	22.5	18.35	.9734	.9725	.9715
46	79.03	23.0	18.77	.9729	.9720	.9710
47	78.58	23.5	19.19	.9724	.9714	.9704
48	78.14	24.0	19.60	.9718	.9708	.9698
49	77 69	24.5	20.02	.9713	.9703	.9692
50	77.24	25.0	20.44	.9708	.9697	.9686
51	76.79	25.5	20.86	.9703	.9691	.9679
52	76.34	26.0	21.28	.9697	.9686	.9673
53	75.89	26.5	21.71	.9692	.9680	.9667
54	75.44	27.0	22.13	.9687	.9674	.9661
55	74.98	27.5	22.55	.9681	.9668	.9654
56	74.53	28.0	22.97	.9676	.9662	.9648
57	74.08	28.5	23.40	.9670	.9656	.9642
58	73.62	29.0	23.82	.9664	.9650	.9635
59	73.17	29.5	24.24	.9659	.9644	.9629
60	72.72	30.0	24.67	.9653	.9638	.9622
61	72.26	30.5	25.10	.9647	.9632	.9616
62	71.81	31.0	25.52	.9641	.9626	.9609
63	71.35	31.5	25.95	.9635	.9619	.9602
64	70.89	32.0	26.38	.9629	.9613	.9595
65	70.13	32.5	26.81	.9623	.9606	.9588
66	66.97	33.0	27.24	.9616	.9599	.9581
67	69.51	33.5	27.67	.9610	.9593	.9574
68	69.05	34.0	28.10	.9604	.9586	.9567
69	68.59	34.5	28.54	.9597	.9579	.9559
70	68.12	35.0	28.97	.9590	.9572	.9552
71	67.66	35.5	29.41	.9584	.9565	.9544
72	67.19	36.0	29.84	.9576	.9557	.9537
73	66.72	36.5	30.28	.9570	.9550	.9529
74	66.25	37.0	30.72	.9562	.9542	.9521
75	65.78	37.5	31.16	.9555	.9535	.9513
76	65.31	38.0	31.60	.9548	.9527	.9505
77	64.84	38.5	32.04	.9540	.9519	.9497
78	64.37	39.0	32.48	.9533	.9512	.9489
79	63.90	39.5	32.92	.9525	.9504	.9481
80	63.42	40.0	33.36	.9517	.9496	.9473
81	62.95	40.5	33.81	.9509	.9488	.9464
82	62.47	41.0	34.25	.9501	.9479	.9456
83	61.99	41.5	34.70	.9493	.9471	.9447

*The parts by volume of water and the parts by volume of ethyl alcohol do not add to unity (100) at any one proof reading, because of the shrinkage in volume which occurs when ethyl alcohol and water are mixed. The *parts by volume* of ethyl alcohol are the same as *percent by volume* of ethyl alcohol used to determine proof for tax purposes. Ethyl alcohol proof, by legal definition, is twice the percent by volume.

(continued)

Table 6.36: (continued)

U.S. PROOF degrees at 60°F	PARTS BY VOLUME* OF		WEIGHT % ETHYL ALCOHOL	SPECIFIC GRAVITY		
	WATER	ETHYL ALCOHOL		at 60°/60°F (15.56°/15.56°C)	at 68°/68°F (20°/20°C)	at 77°/77°F (25°/25°C)
84	61.52	42.0	35.15	.9485	.9463	.9439
85	61.04	42.5	35.60	.9477	.9454	.9430
86	60.56	43.0	36.05	.9469	.9446	.9421
87	60.08	43.5	36.50	.9460	.9437	.9412
88	59.59	44.0	36.96	.9452	.9428	.9403
89	59.11	44.5	37.41	.9443	.9419	.9394
90	58.63	45.0	37.86	.9434	.9410	.9385
91	58.14	45.5	38.32	.9426	.9402	.9376
92	57.66	46.0	38.78	.9417	.9292	.9366
93	57.17	46.5	39.24	.9408	.9383	.9357
94	56.68	47.0	39.70	.9399	.9374	.9348
95	56.19	47.5	40.16	.9389	.9364	.9338
96	55.70	48.0	40.62	.9380	.9355	.9328
97	55.21	48.5	41.09	.9371	.9345	.9319
98	54.72	49.0	41.55	.9361	.9336	.9309
99	54.22	49.5	42.02	.9352	.9326	.9299
100	53.73	50.0	42.49	.9342	.9316	.9289
101	53.24	50.5	42.96	.9332	.9306	.9279
102	52.74	51.0	43.43	.9322	.9296	.9269
103	52.25	51.5	43.90	.9312	.9286	.9258
104	51.75	52.0	44.37	.9302	.9276	.9248
105	51.25	52.5	44.85	.9292	.9266	.9238
106	50.75	53.0	45.33	.9282	.9256	.9228
107	50.26	53.5	45.80	.9272	.9245	.9217
108	49.76	54.0	46.28	.9262	.9235	.9207
109	49.26	54.5	46.76	.9252	.9225	.9196
110	48.76	55.0	47.24	.9241	.9214	.9185
111	48.25	55.5	47.73	.9230	.9204	.9175
112	47.75	56.0	48.21	.9220	.9193	.9164
113	47.25	56.5	48.70	.9210	.9182	.9153
114	46.75	57.0	49.19	.9199	.9171	.9142
115	46.24	57.5	49.68	.9188	.9161	.9131
116	45.74	58.0	50.17	.9177	.9150	.9120
117	45.23	58.5	50.66	.9166	.9139	.9109
118	44.72	59.0	51.15	.9156	.9128	.9098
119	44.22	59.5	51.65	.9144	.9116	.9087
120	43.71	60.0	52.15	.9133	.9105	.9076
121	43.20	60.5	52.65	.9122	.9094	.9064
122	42.69	61.0	53.15	.9111	.9083	.9053

*The parts by volume of water and the parts by volume of ethyl alcohol do not add to unity (100) at any one proof reading, because of the shrinkage in volume which occurs when ethyl alcohol and water are mixed. The *parts by volume* of ethyl alcohol are the same as *percent by volume* of ethyl alcohol used to determine proof for tax purposes. Ethyl alcohol proof, by legal definition, is twice the percent by volume.

(continued)

Table 6.36: (continued)

U.S. PROOF degrees at 60°F	PARTS BY VOLUME* OF		WEIGHT % ETHYL ALCOHOL	SPECIFIC GRAVITY		
	WATER	ETHYL ALCOHOL		at 60°/60°F (15.56°/15.56°C)	at 68°/68°F (20°/20°C)	at 77°/77°F (25°/25°C)
123	42.18	61.5	53.65	.9100	.9071	.9041
124	41.67	62.0	54.15	.9088	.9060	.9030
125	41.16	62.5	54.66	.9077	.9048	.9018
126	40.65	63.0	55.16	.9065	.9037	.9006
127	40.14	63.5	55.67	.9054	.9025	.8995
128	39.62	64.0	56.18	.9042	.9014	.8983
129	39.11	64.5	56.70	.9031	.9002	.8971
130	38.60	65.0	57.21	.9019	.8990	.8959
131	38.08	65.5	57.72	.9007	.8978	.8948
132	37.57	66.0	58.24	.8996	.8966	.8936
133	37.05	66.5	58.76	.8984	.8954	.8924
134	36.54	67.0	59.28	.8972	.8942	.8912
135	36.02	67.5	59.80	.8960	.8930	.8899
136	35.50	68.0	60.32	.8948	.8918	.8887
137	34.99	68.5	60.85	.8936	.8906	.8875
138	34.47	69.0	61.38	.8923	.8894	.8862
139	33.95	69.5	61.91	.8911	.8882	.8850
140	33.43	70.0	62.44	.8899	.8869	.8838
141	32.91	70.5	62.98	.8886	.8856	.8825
142	32.38	71.0	63.51	.8874	.8844	.8812
143	31.86	71.5	64.05	.8861	.8831	.8800
144	31.34	72.0	64.59	.8848	.8819	.8787
145	30.82	72.5	65.13	.8836	.8806	.8774
146	30.29	73.0	65.67	.8823	.8793	.8761
147	29.76	73.5	66.22	.8810	.8780	.8748
148	29.24	74.0	66.77	.8797	.8767	.8735
149	28.71	74.5	67.32	.8784	.8754	.8722
150	28.19	75.0	67.87	.8771	.8741	.8709
151	27.66	75.5	68.43	.8758	.8728	.8696
152	27.13	76.0	68.98	.8745	.8715	.8682
153	26.60	76.5	69.54	.8732	.8702	.8669
154	26.07	77.0	70.10	.8718	.8688	.8655
155	25.54	77.5	70.67	.8705	.8674	.8642
156	25.01	78.0	71.23	.8691	.8661	.8628
157	24.47	78.5	71.80	.8678	.8647	.8614
158	23.94	79.0	72.38	.8664	.8633	.8600
159	23.40	79.5	72.95	.8650	.8620	.8586
160	22.87	80.0	73.53	.8636	.8606	.8572
161	22.33	80.5	74.11	.8622	.8592	.8558

*The parts by volume of water and the parts by volume of ethyl alcohol do not add to unity (100) at any one proof reading, because of the shrinkage in volume which occurs when ethyl alcohol and water are mixed. The *parts by volume* of ethyl alcohol are the same as *percent by volume* of ethyl alcohol used to determine proof for tax purposes. Ethyl alcohol proof, by legal definition, is twice the percent by volume.

(continued)

Table 6.36: (continued)

U.S. PROOF degrees at 60°F	PARTS BY VOLUME* OF		WEIGHT % ETHYL ALCOHOL	SPECIFIC GRAVITY		
	WATER	ETHYL ALCOHOL		at 60°/60°F (15.56°/15.56°C)	at 68°/68°F (20°/20°C)	at 77°/77°F (25°/25°C)
162	21.80	81.0	74.69	.8608	.8577	.8544
163	21.26	81.5	75.27	.8594	.8563	.8530
164	20.72	82.0	75.86	.8580	.8549	.8516
165	20.18	82.5	76.45	.8566	.8535	.8501
166	19.64	83.0	77.04	.8552	.8520	.8487
167	19.10	83.5	77.64	.8537	.8506	.8472
168	18.55	84.0	78.23	.8522	.8491	.8458
169	18.01	84.5	78.84	.8508	.8476	.8443
170	17.46	85.0	79.44	.8493	.8461	.8428
171	16.92	85.5	80.05	.8478	.8446	.8413
172	16.37	86.0	80.66	.8462	.8431	.8398
173	15.82	86.5	81.28	.8447	.8416	.8382
174	15.27	87.0	81.90	.8432	.8400	.8367
175	14.72	87.5	82.52	.8416	.8385	.8351
176	14.16	88.0	83.14	.8401	.8369	.8335
177	13.61	88.5	83.78	.8385	.8353	.8319
178	13.05	89.0	84.41	.8369	.8337	.8303
179	12.49	89.5	85.05	.8353	.8321	.8287
180	11.93	90.0	85.69	.8336	.8305	.8271
181	11.37	90.5	86.34	.8320	.8288	.8254
182	10.80	91.0	86.99	.8303	.8271	.8237
183	10.24	91.5	87.65	.8286	.8254	.8220
184	9.67	92.0	88.31	.8268	.8237	.8203
185	9.09	92.5	88.98	.8251	.8219	.8185
186	8.52	93.0	89.65	.8233	.8201	.8167
187	7.94	93.5	90.34	.8215	.8183	.8149
188	7.36	94.0	91.02	.8196	.8164	.8130
189	6.77	94.5	91.72	.8178	.8146	.8111
190	6.18	95.0	92.42	.8158	.8126	.8092
191	5.59	95.5	93.14	.8138	.8107	.8072
192	4.99	96.0	93.85	.8118	.8087	.8052
193	4.39	96.5	94.58	.8098	.8066	.8032
194	3.78	97.0	95.32	.8077	.8045	.8011
195	3.17	97.5	96.07	.8056	.8024	.7990
196	2.55	98.0	96.82	.8033	.8002	.7968
197	1.93	98.5	97.60	.8010	.7978	.7944
198	1.29	99.0	98.38	.7987	.7955	.7921
199	.65	99.5	99.19	.7962	.7930	.7896
200	.00	100.0	100.00	.7936	.7905	.7871

U.S. Department of Commerce. STANDARD DENSITY AND VOLUMETRIC TABLES. CIRCULAR OF THE BUREAU OF STANDARDS NO. 19 (Washington: U.S. Government Printing Office, 1924) pp. 8, 9 & 18

U.S. Treasury Department, GAUGING MANUAL EMBRACING INSTRUCTIONS AND TABLES FOR DETERMINING THE QUANTITY OF DISTILLED SPIRITS BY PROOF AND WEIGHT (Washington: U.S. Government Printing Office, 1970).

Specific Gravity at 20°/20°C and 25°/25°C from Table 52.003, OFFICIAL METHODS OF ANALYSIS OF THE ASSOCIATION OF OFFICIAL ANALYTICAL CHEMISTS, Twelfth Edition, 1975.

* The parts by volume of water and the parts by volume of ethyl alcohol do not add to unity (100) at any one proof reading, because of the shrinkage in volume which occurs when ethyl alcohol and water are mixed. The *parts by volume* of ethyl alcohol are the same as *percent by volume* of ethyl alcohol used to determine proof for tax purposes. Ethyl alcohol proof, by legal definition, is twice the percent by volume.

Table 6.37: Specially Denatured Alcohols *(30)*

AUTHORIZED COMPOSITION:

	SDA 1-1[1]				SDA 1-2[2]				SDA 2B-1				Test Method
To every 100 gallons of alcohol add:													
Methyl Alcohol, gallons	4				4				—				
Denatonium Benzoate, N.F. avdp. oz.	⅛				—				—				
Methyl Isobutyl Ketone, gallons	—				1				—				
Benzene, gallons	—				—				0.5				
Rubber Hydrocarbon Solvent, gallons	—				—				—				
Toluene, gallons	—				—				—				
Metallic Sodium, pounds	—				—				—				
FORMULATION:	190° Min.	190° Max.	Anhydrous Min.	Anhydrous Max.	190° Min.	190° Max.	Anhydrous Min.	Anhydrous Max.	190° Min.	190° Max.	Anhydrous Min.	Anhydrous Max.	
SPECIFICATIONS:													
Specific gravity @ 15.56°C/15.56°C (60°F/60°F)	0.8144	0.8156	0.7934	0.7944	0.8142	0.8154	0.7934	0.7944	0.8154	0.8166	0.7939	0.7949	ASTM D-891
@ 20°C/20°C	0.8113	0.8124	0.7902	0.7912	0.8111	0.8122	0.7902	0.7912	0.8122	0.8134	0.7908	0.7918	
@ 25°C/25°C	0.8078	0.8090	0.7868	0.7879	0.8076	0.8088	0.7868	0.7879	0.8088	0.8100	0.7874	0.7884	
Acidity, wt/wt% as acetic acid	—	0.0025	—	0.0025	—	0.0025	—	0.0025	—	0.0025	—	0.0025	ASTM D-1613
Non-volatile matter, grams/100 ml	—	0.0025	—	0.0025	—	0.0025	—	0.0025	—	0.0025	—	0.0025	ASTM D-1353
Color, Pt-Co	—	10	—	10	—	10	—	10	—	10	—	10	ASTM D-1209
Water content, vol/vol %	—	—	—	0.10	—	—	—	0.10	—	—	—	0.10	ASTM D-1364
Odor	Typical				Typical				Typical				Organoleptic
TYPICAL PROPERTIES:													
Apparent proof at 60°F	190.4		199.9		190.5		199.9		189.9		199.7		I.R.S. Gauging Manual
Composition wt/wt%													
Ethyl Alcohol	88.95		96.14		88.12		95.22		91.92		99.45		
Methyl Alcohol	3.76		3.86		3.72		3.82		—		—		
Denatonium Benzoate	0.001		0.001		—		—		—		—		
Methyl Isobutyl Ketone	—		—		0.94		0.96		—		—		
Benzene	—		—		—		—		0.54		0.55		
Rubber Hydrocarbon Solvent	—		—		—		—		—		—		
Toluene	—		—		—		—		—		—		
Metallic sodium	—		—		—		—		—		—		
Water	7.29		—		7.22		—		7.54		—		
Coefficient of expansion													
Per 1°C	0.0010		0.0011		0.0010		0.0011		0.0010		0.0010		
Per 1°F	0.0006		0.0006		0.0006		0.0006		0.0006		0.0006		
Flash point													
Tag closed cup													ASTM D-56
°C	13		12		14		11		18		12		
°F	56		53		58		52		64		54		
Tag open cup													ASTM D-1310
°C	23		22		18		16		18		16		
°F	73		71		65		60		65		60		
Pounds per gallon @ 60°F, per 27 CFR 212.115	6.788		6.612		6.788		6.611[3]		6.795		6.612		
Shipping containers													
Tank cars	✓				✓				✓				
Tank trucks	✓				✓				✓				
Drums	✓				✓				✓				
Pails	✓				✓				✓				

Comments:

1. Wood alcohol is an authorized denaturant for SDA 1 (27 CFR 212.16) but it is of no present commercial importance.
2. This formula must be used in a closed end continuous system unless it is shown that it is not practical to do so.
3. Determined by U.S.I.
4. 27 CFR 212.18 authorizes the use of one-half gallon rubber hydrocarbon solvent or toluene in lieu of benzene. Metallic sodium in excess of 33 pounds is also authorized. SDA 2C is only supplied in the anhydrous formulation. It must be used in a closed and continuous system unless it is shown that it is not practical to do so.

(continued)

Table 6.37: (continued)

AUTHORIZED COMPOSITION:

	SDA 2B-2[2]				SDA 2B-3[2]				SDA 2C-1[4]	SDA 3A				Test Method
To every 100 gallons of alcohol add:														
Methyl Alcohol, gallons	—				—				—	5				
Denatonium Benzoate, N.F. avdp. oz.	—				—				—	—				
Methyl Isobutyl Ketone, gallons	—				—				0.5	—				
Benzene, gallons	—				—				—	—				
Rubber Hydrocarbon Solvent, gallons	0.5				0.5				—	—				
Toluene, gallons	—				—				33	—				
Metallic Sodium, pounds	—				—									
FORMULATION:	190° Min.	190° Max.	Anhydrous Min.	Anhydrous Max.	190° Min.	190° Max.	Anhydrous Min.	Anhydrous Max.	Anhydrous Min.	Anhydrous Max.	190° Min.	190° Max.	Anhydrous Min.	Anhydrous Max.	
SPECIFICATIONS:														
Specific gravity @ 15.56°C 15.56°C (60°F 60°F)	0.8144	0.8156	0.7926	0.7936	0.8154	0.8166	0.7936	0.7946	0.8339	0.8372	0.8144	0.8156	0.7934	0.7944	ASTM D-891
@ 20°C 20°C	0.8113	0.8124	0.7895	0.7905	0.8122	0.8134	0.7905	0.7915	0.8308	0.8340	0.8113	0.8124	0.7902	0.7912	
@ 25°C 25°C	0.8078	0.8090	0.7862	0.7871	0.8088	0.8100	0.7871	0.7882	0.8274	0.8306	0.8078	0.8090	0.7869	0.7879	
Acidity, wt. wt% as acetic acid	—	0.0025	—	0.0025	—	0.0025	—	0.0025			—	0.0025	—	0.0025	ASTM D-1613
Non-volatile matter, grams 100 ml	—	0.0025	—	0.0025	—	0.0025	—	0.0025			—	0.0025	—	0.0025	ASTM D-1353
Color, Pt-Co	—	10	—	10	—	10	—	10			—	10	—	10	ASTM D-1209
Water content, vol/vol %	—	—	—	0.10	—	—	—	0.10			—	—	—	0.10	ASTM D-1364
Odor	Typical				Typical				Typical		Typical				Organoleptic
TYPICAL PROPERTIES:														
Apparent proof at 60°F	190.4		200.2		189.9		199.8		178.8		190.4		199.9		I.R.S. Gauging Manual
Composition wt/wt%															
Ethyl Alcohol	92.03		99.56		91.93		99.45				88.12		95.22		
Methyl Alcohol	—		—		—		—				4.65		4.78		
Denatonium Benzoate	—		—		—		—				—		—		
Methyl Isobutyl Ketone	—		—		—		—				—		—		
Benzene	—		—		—		—				—		—		
Rubber Hydrocarbon Solvent	0.42		0.44		—		—				—		—		
Toluene	—		—		0.53		0.55				—		—		
Metallic sodium	—		—		—		—				—		—		
Water	7.55		—		7.54		—				7.23		—		
Coefficient of expansion															
Per 1°C	0.0010		0.0010		0.0010		0.0011		0.0010		0.0010		0.0011		
Per 1°F	0.0006		0.0006		0.0006		0.0006		0.0006		0.0006		0.0006		
Flash point															ASTM D-56
Tag closed cup															
°C	15		13		16		14				16		13		
°F	59		56		61		57				60		55		
Tag open cup															ASTM D-1310
°C	16		13		21		19		16		18		16		
°F	60		55		69		66		60		65		60		
Pounds per gallon @ 60°F per 27 CFR 212.115	6.788[3]		6.606[3]		6.797[3]		6.613[3]		6.959		6.785		6.609		
Shipping containers															
Tank cars	✓				✓				No						
Tank trucks	✓				✓				No						
Drums	✓				✓										
Pails	✓				✓				No						

Comments

1. Wood alcohol is an authorized denaturant for SDA 1 (27 CFR 212.16) but it is of no present commercial importance.
2. This formula must be used in a closed end continuous system unless it is shown that it is not practical to do so.
3. Determined by U.S.I.
4. 27 CFR 212.18 authorizes the use of one-half gallon rubber hydrocarbon solvent or toluene in lieu of benzene. Metallic sodium in excess of 33 pounds is also authorized. SDA 2C is only supplied in the anhydrous formulation. It must be used in a closed and continuous system unless it is shown that it is not practical to do so.

(continued)

Table 6.37: (continued)

AUTHORIZED COMPOSITION:

	SDA 4[3]	SDA 6B		SDA 12A-1		Test Method
To every 100 gallons of alcohol add:						
Nicotine, solution[2] gallons	1	—		—		
Pyridine Bases, gallons	—	0.5		—		
Benzene, gallons	—	—		5		
Rubber Hydrocarbon Solvent, gallons	—	—		—		
Toluene, gallons	—	—		—		
Ethyl Ether, gallons	—	—		—		
FORMULATION:	190° Min. / Max.	190° Min. / Max.	Anhydrous Min. / Max.	190° Min. / Max.	Anhydrous Min. / Max.	
SPECIFICATIONS:						
Specific gravity @ 15.56°C/15.56°C (60°F 60°F)	0.8181 / 0.8193	0.8160 / 0.8172	0.7939 / 0.7949	0.8183 / 0.8194	0.7972 / 0.7986	ASTM D-891
@ 20°C/20°C	0.8149 / 0.8161	0.8128 / 0.8140	0.7907 / 0.7918	0.8151 / 0.8162	0.7940 / 0.7955	
@ 25°C/25°C	0.8115 / 0.8126	0.8094 / 0.8105	0.7873 / 0.7884	0.8117 / 0.8128	0.7907 / 0.7921	
Acidity, wt/wt% as acetic acid	— / 0.0025	← alkaline →		— / 0.0025	— / 0.0025	ASTM D-1613
Non-volatile matter, grams/100 ml	— / 0.01	— / 0.0025	— / 0.0025	— / 0.0025	— / 0.0025	ASTM D-1353
Color, Pt-Co	Blue	— / 30	— / 30	— / 10	— / 10	ASTM D-1209
Water content, vol/vol %	— / —	— / —	— / 0.20	— / —	— / 0.10	ASTM D-1364
Odor	Typical	Typical		Typical		Organoleptic
TYPICAL PROPERTIES:						
Apparent proof at 60°F	188.5	189.6	199.7	188.4	198.3	I.R.S. Gauging Manual
Composition, wt/wt%						
Ethyl Alcohol	91.30	91.88	99.38	87.69	94.73	
Nicotine	0.024	—	—	—	—	
Methylene Blue	0.0003	—	—	—	—	
Pyridine Bases	—	0.59	0.62	—	—	
Benzene	—	—	—	5.12	5.27	
Rubber Hydrocarbon Solvent	—	—	—	—	—	
Toluene	—	—	—	—	—	
Ethyl Ether	—	—	—	—	—	
Water	8.68	7.53	—	7.19	—	
Coefficient of expansion						
Per 1°C	0.0010	0.0010	0.0010	0.0011	0.0011	
Per 1°F	0.0006	0.0006	0.0006	0.0006	0.0006	
Flash point						ASTM D-56
Tag closed cup						
C°	17	18	17	6	6	
F°	63	64	62	42	42	
Tag open cup						ASTM D-1310
C°	18	18	16	10	7	
F°	65	65	60	50	45	
Pounds per gallon @ 60°F, per 27 CFR 212.115	6.823	6.801	6.618	6.820	6.645	
Shipping containers						
Tank cars	✓	✓		✓		
Tank trucks	✓	✓		✓		
Drums	✓	✓		✓		
Pails	✓	✓		✓		

Comments:

1. SDA 3B, prepared by the addition of one gallon pine tar N.F. to every 100 gallons alcohol, is an ATF authorized formulation. Because of very limited use, it is not discussed in this book.
2. Nicotine Solution Composition: Five gallons of an aqueous solution containing 40 percent nicotine and 3.6 av. ounces of methylene blue N.F., plus sufficient water to make 100 gallons.
3. Available in 190 formulation only.
4. Determined by U.S.I.
5. SDA 17, prepared by the addition of 0.05 gallon (6.4 fluid ounces) of bone oil (Dipple's Oil) to every 100 gallons alcohol, is an ATF authorized formulation. Because of very limited use it is not discussed in this book.

(continued)

Table 6.37: (continued)

AUTHORIZED COMPOSITION:

	SDA 12A-3				SDA 13A				Test Method
To every 100 gallons of alcohol add:									
Nicotine, solution[2], gallons									
Pyridine Bases, gallons									
Benzene, gallons									
Rubber Hydrocarbon Solvent, gallons									
Toluene, gallons			5				10		
Ethyl Ether, gallons			—				—		
FORMULATION:	190° Min.	190° Max.	Anhydrous Min.	Anhydrous Max.	190° Min.	190° Max.	Anhydrous Min.	Anhydrous Max.	
SPECIFICATIONS:									
Specific gravity @ 15.56°C/15.56°C (60°F/60°F)	0.8077	0.8189	0.7972	0.7986	0.8067	0.8100	0.7883	0.7895	ASTM D-891
@ 20°C/20°C	0.8146	0.8157	0.7940	0.7955	0.8056	0.8068	0.7857	0.7863	
@ 25°C/25°C	0.8111	0.8123	0.7907	0.7921	0.8022	0.8034	0.7816	0.7828	
Acidity, wt/wt% as acetic acid	—	0.0025	—	0.0025	—	0.0025	—	0.0025	ASTM D-1613
Non-volatile matter, grams/100 ml	—	0.0025	—	0.0025	—	0.0025	—	0.0025	ASTM D-1353
Color, Pt-Co	—	10	—	10	—	10	—	10	ASTM D-1209
Water content, vol/vol %	—	—	—	0.10	—	—	—	0.10	ASTM D-1364
Odor	Typical				Typical				Organoleptic
TYPICAL PROPERTIES:									I.R.S. Gauging Manual
Apparent proof at 60°F	188.7		198.3		193.2		~200		
Composition, wt/wt%									
Ethyl Alcohol	87.74		94.78		85.07		91.81		
Nicotine			—		—				
Methylene Blue			—		—				
Pyridine Bases			—		—				
Benzene			—		—				
Rubber Hydrocarbon Solvent			—		—				
Toluene	5.07		5.22		7.92		8.15		
Ethyl Ether			—		—				
Water	7.19		—		7.01		0.04		
Coefficient of expansion									
Per 1°C	0.0011		0.0011		0.0011		0.0012		
Per 1°F	0.0006		0.0006		0.0006		0.0006		
Flash point									ASTM D-56
Tag closed cup									
C°	11		9		−14		−16		
F°	52		49		6		4		
Tag open cup									ASTM D-1310
C°	18		16		−12		−12		
F°	65		60		10		10		
Pounds per gallon @ 60°F, per 27 CFR 212.115	6.815[4]		6.644[4]		6.740		6.572		
Shipping containers									
Tank cars			✓				✓		
Tank trucks			✓				✓		
Drums			✓				✓		
Pails			✓				✓		

Comments:

1. SDA 3B, prepared by the addition of one gallon pine tar N.F. to every 100 gallons alcohol, is an ATF authorized formulation. Because of very limited use, it is not discussed in this book.
2. Nicotine Solution Composition: Five gallons of an aqueous solution containing 40 percent nicotine and 3.6 av. ounces of methylene blue N.F., plus sufficient water to make 100 gallons.
3. Available in 190° formulation only.
4. Determined by U.S.I.
5. SDA 17, prepared by the addition of 0.05 gallon (6.4 fluid ounces) of bone oil (Dipple's Oil) to every 100 gallons alcohol, is an ATF authorized formulation. Because of very limited use it is not discussed in this book.

(continued)

Table 6.37: (continued)

AUTHORIZED COMPOSITION:

	SDA 20[3]	SDA 22[4]	SDA 23A		Test Method
To every 100 gallons of alcohol add:					
Chloroform, gallons	5	—	—		
Formaldehyde, Solution U.S.P., gallons	—	10	—		
Acetone, N.F., gallons	—	—	8		
Salicylic Acid, N.F., pounds	—	—	—		
Resorcin, U.S.P. pounds	—	—	—		
Bergamot Oil, N.F., gallons	—	—	—		
Methyl Isobutyl Ketone, gallons	—	—	—		
FORMULATION:	Anhydrous	190[5]	190[5]	Anhydrous	
	Minimum Maximum	Minimum Maximum	Minimum Maximum	Minimum Maximum	
SPECIFICATIONS:					
Specific gravity @ 15.56°C/15.56°C (60°F/60°F)	0.8265 0.8282	0.8444 0.8462	0.8144 0.8156	0.7939 0.7949	ASTM D-891
@ 20°C/20°C	0.8233 0.8251	0.8413 0.8431	0.8113 0.8124	0.7908 0.7918	
@ 25°C/25°C	0.8199 0.8216	0.8379 0.8398	0.8078 0.8090	0.7874 0.7884	
Acidity, wt/wt% as acetic acid	— 0.0050	— 0.010	— 0.0025	— 0.0025	ASTM D-1613
Non-volatile matter, grams/100 ml	— 0.0025	— 0.0025	— 0.0025	— 0.0025	ASTM D-1353
Color, Pt-Co	— 10	— 10	— 10	— 10	ASTM D-1209
Water content, vol/vol %	— 0.10	— —	— —	— 0.10	ASTM D-1364
Odor	Typical	Typical	Typical		Organoleptic
TYPICAL PROPERTIES:					
Apparent proof at 60°F	183.7	172.6	190.4	199.7	I.R.S. Gauging Manual
Composition, wt/wt%					
Ethyl Alcohol	91.50	81.50	85.73	92.57	
Chloroform	8.50		—	—	
Formaldehyde	—	4.37	—	—	
Acetone	—	1.42-Methanol	7.24	7.43	
Salicylic Acid	—		—	—	
Resorcin	—		—	—	
Bergamot Oil	—		—	—	
Methyl Isobutyl Ketone	—		—	—	
Water	—	12.71	7.03	—	
Coefficient of expansion					
Per 1°C	0.0011	0.0010	0.0011	0.0011	
Per 1°F	0.0006	0.0006	0.0006	0.0006	
Flash point					ASTM D-56
Tag closed cup					
°C	13	18	6	4	
°F	56	65	43	40	
Tag open cup					ASTM D-1310
°C	13	17	16	16	
°F	55	62	60	60	
Pounds per gallon @ 60°F per 27 CFR 212.115	6.886	7.037	6.788	6.621	
Shipping containers					
Tank cars	No	No	"	"	
Tank trucks	No	No	"	"	
Drums	"	"	"	"	
Pails	"	"	"	"	

Comments

1. SDA 18, prepared by the addition of 100 gallons of vinegar of not less than 90-grain strength or 150 gallons of vinegar of not less than 60-grain strength to every 100 gallons of alcohol is an authorized formula. It is not discussed in this book because of limited commercial importance
2. SDA 19 prepared by the addition of 100 gallons of ethyl ether to every 100 gallons of alcohol is an authorized formula. Because of very limited use it is not discussed in this book.
3. Available in anhydrous formulation only
4. The 190 formulation is typically used
5. 27 CFR 212.31 also authorizes the use of 1 gallon bay oil N.F., in lieu of the 1 gallon bergamot oil N.F.

(continued)

Table 6.37: (continued)

AUTHORIZED COMPOSITION:

	SDA 23F-1 [5]				SDA 23H				Test Method
To every 100 gallons of alcohol add:									
Chloroform, gallons	—				—				
Formaldehyde, Solution U.S.P., gallons	—				—				
Acetone, N.F., gallons	—				8				
Salicylic Acid, N.F., pounds	3				—				
Resorcin, U.S.P. pounds	1				—				
Bergamot Oil, N.F., gallons	1				—				
Methyl Isobutyl Ketone, gallons	—				1.5				
FORMULATION:	190° Minimum	190° Maximum	Anhydrous Minimum	Anhydrous Maximum	190° Minimum	190° Maximum	Anhydrous Minimum	Anhydrous Maximum	
SPECIFICATIONS:									
Specific gravity @ 15.56 C (15.56 C (60 F/60 F)	0.8193	0.8204	0.7964	0.7979	0.8140	0.8152	0.7942	0.7952	ASTM D-891
@20 C/20 C	0.8161	0.8172	0.7932	0.7948	0.8109	0.8120	0.7910	0.7920	
@25 C/25 C	0.8126	0.8138	0.7899	0.7914	0.8074	0.8086	0.7876	0.7886	
Acidity, wt wt% as acetic acid	0.10	0.20	0.10	0.20	—	0.0025	—	0.0025	ASTM D-1613
Non-volatile matter, grams/100 ml	N.A		N.A		—	0.0025	—	0.0025	ASTM D-1353
Color, Pt-Co	Pale Green		Pale Green		—	10	—	10	ASTM D-1209
Water content, vol vol %	—	—	—	0.40	—	—	—	0.10	ASTM D-1364
Odor	Typical				Typical				Organoleptic
TYPICAL PROPERTIES:									I.R.S. Gauging Manual
Apparent proof at 60 F	187.9		198.6		190.6		199.6		
Composition, wt wt%									
Ethyl Alcohol	90.91		98.26		84.58		91.29		
Chloroform	—		—		—		—		
Formaldehyde	—		—		7.14		7.33		
Acetone	—		—		—		—		
Salicylic Acid	0.43		0.45		—		—		
Resorcin	0.14		0.15		—		—		
Bergamot Oil	1.06		1.09		1.35		1.38		
Methyl Isobutyl Ketone	—		—		6.93		—		
Water	7.46		—						
Coefficient of expansion									
Per 1 C	0.0010		0.0010		0.0011		0.0011		
Per 1 F	0.0006		0.0006		0.0006		0.0006		
Flash point									ASTM D-56
Tag closed cup									
C	16		13		6		2		
F	60		56		43		36		ASTM D-1310
Tag open cup									
C	18		18		10		2		
F	65		65		50		35		
Pounds per gallon @ 60 F per 27 CFR 212.115	6.808		6.627		6.785		6.617		
Shipping containers									
Tank cars	No								
Tank trucks	No								
Drums	No								
Pails	—Polyethylene lined								

Comments

1. SDA 18, prepared by the addition of 100 gallons of vinegar of not less than 90-grain strength or 150 gallons of vinegar of not less than 60-grain strength to every 100 gallons of alcohol is an authorized formula. It is not discussed in this book because of limited commercial importance.
2. SDA 19 prepared by the addition of 100 gallons of ethyl ether to every 100 gallons of alcohol is an authorized formula. Because of very limited use it is not discussed in this book.
3. Available in anhydrous formulation only.
4. The 190° formulation is typically used.
5. 27 CFR 212.31 also authorizes the use of 1 gallon bay oil N.F. in lieu of the 1 gallon bergamot oil N.F.

(continued)

Table 6.37: (continued)

AUTHORIZED COMPOSITION:

	SDA 25-1 [1]	SDA 25-2 [1]	SDA 25A-1 [1]	SDA 25A-2 [1]	Test Method
To every 100 gallons of alcohol add:					
Iodine, U.S.P., pounds	20	20	20	20	
Potassium Iodide, U.S.P., pounds	15	—	15	—	
Sodium Iodide, U.S.P., pounds	—	15	—	15	
Water, pounds	—	—	15	15	
Rosemary Oil, N.F., gallons	—	—	—	—	
Camphor, U.S.P., pounds	—	—	—	—	
Clove Oil, U.S.P., gallons	—	—	—	—	
Lavender Oil, U.S.P., gallons	—	—	—	—	
Medicinal Soft Soap, U.S.P. pounds [2]	—	—	—	—	
FORMULATION:	190°	190°	190°	190°	
	Minimum Maximum	Minimum Maximum	Minimum Maximum	Minimum Maximum	
SPECIFICATIONS:					
Specific gravity @ 15.56°C/15.56°C (60°F/60°F)	0.8491 0.8521	0.8494 0.8523	0.8535 0.8564	0.8541 0.8571	ASTM D-891
@ 20°C/20°C	0.8460 0.8490	0.8463 0.8492	0.8504 0.8533	0.8510 0.8539	
@ 25°C/25°C	0.8426 0.8456	0.8429 0.8459	0.8471 0.8500	0.8476 0.8506	
Acidity, wt/wt% as acetic acid	— —	— —	— —	— —	ASTM D-1613
Non-volatile matter, grams/100 ml	— —	— —	— —	— —	ASTM D-1353
Color, Pt-Co	Deep Red-Brown	Deep Red-Brown	Deep Red-Brown	Deep Red-Brown	ASTM D-1209
Water content, vol/vol %	— —	— —	— —	— —	ASTM D-1364
Odor	Typical	Typical	Typical	Typical	Organoleptic
TYPICAL PROPERTIES:					
Apparent proof at 60°F	169.1	168.9	166.1	165.7	I.R.S. Gauging Manual
Composition, wt/wt%					
Ethyl Alcohol	87.90	87.90	86.09	86.09	
Iodine	2.80	2.80	2.74	2.74	
Potassium Iodide	2.10	—	2.06	—	
Sodium Iodide	—	2.10	—	2.06	
Rosemary Oil	—	—	—	—	
Camphor	—	—	—	—	
Clove Oil	—	—	—	—	
Lavender Oil	—	—	—	—	
Soft Soap	—	—	—	—	
Water	7.20	7.20	9.11	9.11	
Coefficient of expansion					
Per 1°C	0.0010	0.0010	0.0010	0.0010	
Per 1°F	0.0006	0.0006	0.0006	0.0006	
Flash Point					ASTM D-56
Tag closed cup					
C°	16	16	16	16	
F°	60	60	60	60	
Tag open cup					ASTM D-1310
C°	18	18	18	18	
F°	65	65	65	65	
Pounds per gallon @ 60°F, per 27 CFR 212.115	7.080	7.083	7.119	7.117	
Shipping containers					
Tank cars	No	No	No	No	
Tank trucks	No	No	No	No	
Drums	50 gallon, polyethylene returnable drums only		50 gallon, polyethylene returnable drums only		
Pails	No	No	No	No	

Comments:

1. These SDA's typically supplied only in the 190° formulation
2. The requirements of this formula may be met by adding 66.5 pounds of U.S.P. quality soap concentrate containing 25 percent water to 100 gallons of alcohol and, after mixing, by adding thereto 33.5 pounds of water and mixing again.

(continued)

Table 6.37: (continued)

AUTHORIZED COMPOSITION:

	SDA 27				SDA 27A [1]		SDA 27B [1]		Test Method
To every 100 gallons of alcohol add:									
Iodine, U.S.P., pounds	—				—		—		
Potassium Iodide, U.S.P., pounds	—				—		—		
Sodium Iodide, U.S.P., pounds	—				—		—		
Water, pounds	—				—		—		
Rosemary Oil, N.F., gallons	1				—		—		
Camphor, U.S.P., pounds	30				35		—		
Clove Oil, U.S.P., gallons	—				1		—		
Lavender Oil, U.S.P., gallons	—				—		1		
Medicinal Soft Soap, U.S.P. pounds [2]	—				—		100		
FORMULATION:	190° Minimum	190° Maximum	Anhydrous Minimum	Anhydrous Maximum	190° Minimum	190° Maximum	190° Minimum	190° Maximum	
SPECIFICATIONS:									
Specific gravity @ 15.56°C/15.56°C (60°F/60°F)	0.8202	0.8240	0.7996	0.8020	0.8238	0.8263	0.8408	0.8448	ASTM D-891
@ 20°C/20°C	0.8170	0.8207	0.7964	0.7988	0.8207	0.8231	0.8377	0.8417	
@ 25°C/25°C	0.8136	0.8172	0.7930	0.7954	0.8172	0.8197	0.8343	0.8383	
Acidity, wt/wt% as acetic acid	—	0.005	—	0.010	—	0.030	—	—	ASTM D-1613
Non-volatile matter, grams/100 ml	N/A		N/A		N/A		—	—	ASTM D-1353
Color, Pt-Co	—	40	—	40	—	60			ASTM D-1209
Water content, vol/vol %	—	—	—	0.10	—	—	—	—	ASTM D-1364
Odor	Typical				Typical		Typical		Organoleptic
TYPICAL PROPERTIES:									
Apparent proof at 60°F	186.7		197.1		185.2		174.2		I.R.S. Gauging Manual
Composition, wt/wt%									
Ethyl Alcohol	87.58		94.62		86.83		79.79		
Iodine	—		—		—				
Potassium Iodide	—				—				
Sodium Iodide	—				—				
Rosemary Oil	1.06		1.08		—				
Camphor	4.18		4.30		4.84				
Clove Oil	—		—		1.21				
Lavender Oil	—		—		—		0.96		
Soft Soap	—		—		—		6.35		
Water	7.18		—		7.12		12.90		
Coefficient of expansion									
Per 1°C	0.0010		0.0010		0.0010		0.0010		
Per 1°F	0.0006		0.0006		0.0006		0.0006		
Flash Point									ASTM D-56
Tag closed cup									
C°	14		13		16		18		
F°	58		56		60		64		
Tag open cup									ASTM D-1310
C°	18		16		18		18		
F°	65		60		65		65		
Pounds per gallon @ 60°F, per 27 CFR 212.115	6.846		6.670		6.867		7.027		
Shipping containers									
Tank cars	No				No		No		
Tank trucks	No				No		No		
Drums	✓				X		✓		
Pails	✓				X		✓		

X = resin lined containers only.

Comments.

1 These SDA's typically supplied only in the 190° formulation.
2 The requirements of this formula may be met by adding 66.5 pounds of U.S.P. quality soap concentrate containing 25 percent water to 100 gallons of alcohol and, after mixing, by adding thereto 33.5 pounds of water and mixing again.

(continued)

Table 6.37: (continued)

AUTHORIZED COMPOSITION:

	SDA 28A[1]	SDA 29-3[2]		SDA 30	Test Method
To every 100 gallons of alcohol add:					
Gasoline, gallons	1	—		—	
Ethyl Acetate, gallons	—	1		—	
Methyl Alcohol, gallons	—	—		10	
Ethyl Ether, gallons	—	—		—	
FORMULATION:	**Anhydrous**	**190°**	**Anhydrous**	**190°**	
	Minimum Maximum	**Minimum Maximum**	**Minimum Maximum**	**Minimum Maximum**	
SPECIFICATIONS:					
Specific gravity @ 15.56°C/15.56°C (60°F/60°F)	0.7923 0.7933	0.8160 0.8172	0.7944 0.7954	0.8132 0.8146	ASTM D-891
@ 20°C/20°C	0.7891 0.7901	0.8128 0.8140	0.7912 0.7922	0.8101 0.8115	
@ 25°C/25°C	0.7857 0.7867	0.8094 0.8105	0.7879 0.7889	0.8066 0.8080	
Acidity, wt/wt% as acetic acid	— 0.0025	— 0.0025	— 0.0025	— 0.0025	ASTM D-1613
Non-volatile matter, grams/100 ml	— 0.0025	— 0.0025	— 0.0025	— 0.0025	ASTM D-1353
Color, Pt-Co	— 10	— 10	— 10	— 10	ASTM D-1209
Water content, vol/vol %	— 0.20	— —	— 0.10	— —	ASTM D-1364
Odor	Typical	Typical		Typical	Organoleptic
TYPICAL PROPERTIES:					
Apparent Proof at 60°F	>200	189.6	199.5	191.0	I.R.S. Gauging Manual
Composition wt/wt%					
Ethyl Alcohol	99.13	91.41	98.87	84.21	
Gasoline	0.87	—	—	—	
Ethyl Acetate	—	1.10	1.13	—	
Methyl Alcohol	—	—	—	8.89	
Ethyl Ether	—	—	—	—	
Water	—	7.49	—	6.90	
Coefficient of expansion					
Per 1°C	0.0011	0.0010	0.0011	0.0010	
Per 1°F	0.0006	0.0006	0.0006	0.0006	
Flash point					ASTM D-56
Tag closed cup					
C°	7	17	15	16	
F°	45	62	69	60	
Tag open cup					ASTM D-1310
C°	10	16	21	18	
F°	50	60	69	65	
Pounds per gallon @ 60°F, per 27 CFR 212.115	6.603	6.801[6]	6.621[6]	6.785	
Shipping containers					
Tank cars	✓	✓		✓	
Tank trucks	✓	✓		✓	
Drums	✓	✓		✓	
Pails	✓	✓		✓	

Comments:

1. This SDA typically supplied only in the anhydrous formulation.
2. This formulation, typically used for vinegar manufacture, is but one of many which is of commercial importance. Other denaturants may be approved by the ATF director, provided the proposed denaturant be not less than 6.8 pounds of solid, or 1 gallon of liquid to 100 gallons alcohol. This formula is restricted to processes in which the alcohol loses its identity by being converted to other chemicals.
3. SDA 31A, prepared by the addition of 100 pounds of glycerol, U.S.P. and 20 pounds of hard soap, N.F. to 100 gallons alcohol is an ATF authorized formulation. Because of very limited use it is not discussed in this book.
4. SDA 33, prepared by the addition of 30 pounds of methyl violet or methyl violet U.S.P. to 100 gallons alcohol is an ATF authorized formulation. Because of very limited use it is not discussed in this book.
5. SDA 35, prepared by the addition of 29.75 gallons of ethyl acetate having an ester content of 100 percent by weight or the equivalent thereof not to exceed 35 gallons of ethyl acetate with an ester content of not less than 85 percent by weight to 100 gallons alcohol is an ATF authorized formulation. Because of very limited use it is not discussed within this book.
6. Determined by U.S.I.

(continued)

Table 6.37: (continued)

AUTHORIZED COMPOSITION:

	SDA 30		SDA 32				SDA 35A				Test Method
To every 100 gallons of alcohol add:											
Gasoline, gallons	—		—				—				
Ethyl Acetate, gallons	—		—				4.25				
Methyl Alcohol, gallons	10		—				—				
Ethyl Ether, gallons	—		5				—				
FORMULATION:	Anhydrous Minimum	Anhydrous Maximum	190° Minimum	190° Maximum	Anhydrous Minimum	Anhydrous Maximum	190° Minimum	190° Maximum	Anhydrous Minimum	Anhydrous Maximum	
SPECIFICATIONS:											
Specific gravity @ 15.56°C/15.56°C (60°F/60°F)	0.7934	0.7944	0.8122	0.8134	0.7911	0.7921	0.8185	0.8196	0.7974	0.7989	ASTM D-891
@ 20°C/20°C	0.7902	0.7912	0.8091	0.8103	0.7879	0.7889	0.8153	0.8164	0.7942	0.7957	
@ 25°C/25°C	0.7868	0.7879	0.8056	0.8068	0.7845	0.7855	0.8119	0.8130	0.7909	0.7923	
Acidity, wt. wt% as acetic acid	—	0.0025	—	0.0025	—	0.0025	—	0.0025	—	0.0025	ASTM D-1613
Non-volatile matter, grams/100 ml	—	0.0025	—	0.0025	—	0.0025	—	0.0025	—	0.0025	ASTM D-1353
Color, Pt-Co	—	10	—	10	—	10	—	10	—	10	ASTM D-1209
Water content, vol/vol %	—	0.20	—	—	—	0.20	—	—	—	0.10	ASTM D-1364
Odor	Typical		Typical				Typical				Organoleptic
TYPICAL PROPERTIES:											
Apparent Proof at 60°F	199.9		191.5		> 200		188.3		198.2		I.R.S. Gauging Manual
Composition wt/wt%											
Ethyl Alcohol	90.88		88.59		95.73		88.26		95.38		
Gasoline							4.50		4.62		
Ethyl Acetate											
Methyl Alcohol	9.12										
Ethyl Ether			4.13		4.24						
Water			7.28		0.03		7.24				
Coefficient of expansion											
Per 1°C	0.0011		0.0011		0.0011		0.0011		0.0011		
Per 1°F	0.0006		0.0006		0.0006		0.0006		0.0006		
Flash point											ASTM D-56
Tag closed cup											
C°	13		−4		−9		14		10		
F°	53		25		15		58		50		
Tag open cup											ASTM D-1310
C°	13		−4		−9		21		17		
F°	55		25		15		70		62		
Pounds per gallon @ 60°F, per 27 CFR 212.115	6.617		6.769		6.593		6.826		6.649		
Shipping containers											
Tank cars	✓			✓				✓			
Tank trucks	✓			✓				✓			
Drums	✓			✓				✓			
Pails	✓			✓				✓			

Comments:

1. This SDA typically supplied only in the anhydrous formulation.
2. This formulation, typically used for vinegar manufacture, is but one of many which is of commercial importance. Other denaturants may be approved by the ATF director, provided the proposed denaturant be not less than 6.8 pounds of solid, or 1 gallon of liquid to 100 gallons alcohol. This formula is restricted to processes in which the alcohol loses its identity by being converted to other chemicals.
3. SDA 31A, prepared by the addition of 100 pounds of glycerol, U.S.P. and 20 pounds of hard soap, N.F. to 100 gallons alcohol is an ATF authorized formulation. Because of very limited use it is not discussed in this book.
4. SDA 33, prepared by the addition of 30 pounds of methyl violet or methyl violet U.S.P. to 100 gallons alcohol is an ATF authorized formulation. Because of very limited use it is not discussed in this book.
5. SDA 35, prepared by the addition of 29.75 gallons of ethyl acetate having an ester content of 100 percent by weight or the equivalent thereof not to exceed 35 gallons of ethyl acetate with an ester content of not less than 85 percent by weight to 100 gallons alcohol is an ATF authorized formulation. Because of very limited use it is not discussed within this book.
6. Determined by U.S.I.

(continued)

Table 6.37: (continued)

AUTHORIZED COMPOSITION:

	SDA 36[1,2]	SDA 37[1]	TYPICAL SDA 38B	Test Method
To every 100 gallons of alcohol add:				
Ammonia, aqueous, 27 to 30 percent by weight, gallons	3	—		
Eucalyptol, U.S.P., fluid ounces	—	45	Denaturant 10 lbs.	
Thymol N.F. avdp. ounce	—	30		
Menthol, U.S.P., avdp. ounce	—	20		
Formaldehyde Solution, U.S.P., gallons	—	—		
Boric Acid,[4] U.S.P., pounds	—	—		
Chlorothymol, N.F., pounds	—	—		
FORMULATION:	190° Minimum / Maximum	190° Minimum / Maximum	190° / 200°	
SPECIFICATIONS:				
Specific gravity @ 15.56°C/15.56°C (60°F/60°F)	0.8189 / 0.8209	0.8162 / 0.8174	See Table 6.37	ASTM D-891
@ 20°C/20°C	0.8157 / 0.8177	0.8130 / 0.8142		
@ 25°C/25°C	0.8123 / 0.8143	0.8097 / 0.8108		
Acidity, wt/wt% as acetic acid	Alkaline	— / 0.0030		ASTM D-1613
Non-volatile matter, grams/100 ml	— / 0.0025	N/A		ASTM D-1353
Color, Pt-Co	— / 10	— / 20		ASTM D-1209
Water content, vol/vol %	— / —	— / —		ASTM D-1364
Odor	Typical	Typical		Organoleptic
TYPICAL PROPERTIES:				
Apparent proof at 60°F	187.9	189.5	189.4 / 199.3	I.R.S. Gauging Manual
Composition, wt/wt%				
Ethyl Alcohol	89.46	91.64	91.08 / 98.51	
Ammonia	0.91			
Eucalyptol		0.40		
Thymol		0.27		
Menthol		0.18		
Formaldehyde		—		
Boric Acid		—		
Chlorothymol		—	Denaturant 1.45 / 1.49	
Water	9.63	7.51	7.47	
Coefficient of expansion				
Per 1°C	0.0011	0.0010	0.0010 / 0.0010	
Per 1°F	0.0006	0.0006	0.0006 / 0.0006	
Flash point				ASTM D-56
Tag closed cup				
C°	15	13		
F°	59	55		
Tag open cup				ASTM D-1310
C°	20	21		
F°	68	70		
Pounds per gallon @ 60°F, per 27 CFR 212.115	6.837	6.794	6.804 / 6.622	
Shipping containers				
Tank cars	✓	✓	✓	
Tank trucks	✓	✓	✓	
Drums	✓	✓	✓ & ✓	
Pails	✓	✓	✓ & ✓	

Comments:

1. This SDA typically supplied only in the 190° proof formulation
2. Alternate denaturants include: 3 gallons of strong ammonia solution, U.S.P.; 17.5 pounds of caustic soda, liquid grade, containing 50 percent sodium hydroxide by weight; or 12.0 pounds of caustic soda, liquid grade containing 73 percent sodium hydroxide by weight to 100 gallons alcohol.
3. 27 CFR 212.51 also authorizes the use of 7 pounds of boric acid U.S.P. and a total of 3 pounds of any two or more denaturing materials listed under Formula No. 38-B.
4. The use of Polysorbate® 80 is an authorized replacement for boric acid.

(continued)

Table 6.37: (continued)

AUTHORIZED COMPOSITION:

	SDA 38C[1]	SDA 38D[1]	SDA 38F[1,3]	Test Method
To every 100 gallons of alcohol add:				
Ammonia, aqueous, 27 to 30 percent by weight, gallons	—	—	—	
Eucalyptol, U.S.P., fluid ounces	—	—	—	
Thymol N.F. avdp. ounce	—	—	1⅓ lbs	
Menthol, U.S.P., avdp. ounce	10 lbs	2.5 lbs	1⅓ lbs	
Formaldehyde Solution, U.S.P., gallons	1.25	2.5	—	
Boric Acid,[4] U.S.P., pounds	—	—	6	
Chlorothymol, N.F., pounds	—	—	1½	
FORMULATION:	190° Minimum / Maximum	190° Minimum / Maximum	190° Minimum / Maximum	
SPECIFICATIONS:				
Specific gravity @ 15.56°C/15.56°C (60°F/60°F)	0.8202 / 0.8217	0.8231 / 0.8252	0.8194 / 0.8206	ASTM D-891
@ 20°C/20°C	0.8170 / 0.8185	0.8200 / 0.8221	0.8162 / 0.8174	
@ 25°C/25°C	0.8136 / 0.8151	0.8165 / 0.8187	0.8127 / 0.8140	
Acidity, wt/wt% as acetic acid	— / 0.005	— / 0.005	N/A	ASTM D-1613
Non-volatile matter, grams/100 ml	N/A	N/A	N/A	ASTM D-1353
Color, Pt-Co	— / 10	— / 10	— / 10	ASTM D-1209
Water content, vol/vol %	— / —	— / —	— / —	ASTM D-1364
Odor	Typical	Typical	Typical	Organoleptic
TYPICAL PROPERTIES:				
Apparent proof at 60°F	187.3	185.5	187.8	I.R.S. Gauging Manual
Composition, wt/wt%				
Ethyl Alcohol	89.60	89.11	91.09	
Ammonia			0.19	
Eucalyptol	1.43	0.35		
Thymol	0.60	1.20		
Menthol	0.19 Methanol	0.39 Methanol		
Formaldehyde			0.87	
Boric Acid			0.19	
Chlorothymol				
Water	8.18	8.95	7.47	
Coefficient of expansion				
Per 1°C	0.0010	0.0010	0.0010	
Per 1°F	0.0006	0.0006	0.0006	
Flash point				ASTM D-56
Tag closed cup				
C°	17	17	16	
F°	62	63	61	
Tag open cup				ASTM D-1310
C°	19	22	19	
F°	67	71	66	
Pounds per gallon @ 60°F, per 27 CFR 212.115	6.832	6.863	6.828	
Shipping containers				
Tank cars	No	✓	✓	
Tank trucks	No	✓	✓	
Drums	X	X	✓ & X (depending on denaturants)	
Pails	X	X	✓ & X (depending on denaturants)	

X = resin lined containers

Comments:

1. This SDA typically supplied only in the 190° proof formulation
2. Alternate denaturants include: 3 gallons of strong ammonia solution, U.S.P.; 17.5 pounds of caustic soda, liquid grade, containing 50 percent sodium hydroxide by weight; or 12.0 pounds of caustic soda, liquid grade containing 73 percent sodium hydroxide by weight to 100 gallons alcohol.
3. 27 CFR 212.51 also authorizes the use of 7 pounds of boric acid U.S.P. and a total of 3 pounds of any two or more denaturing materials listed under Formula No. 38-B.
4. The use of Polysorbate® 80 is an authorized replacement for boric acid.

(continued)

Table 6.37: (continued)

AUTHORIZED COMPOSITION:	SDA 39B				SDA 39C				SDA 40-1				Test Method
To every 100 gallons of alcohol add:													
Diethyl Phthalate, gallons	2.5				1				—				
tert-Butyl Alcohol, gallons	⅛				—				⅛				
Brucine Alkaloid, avdp ounces	—				—				1½				
Brucine Sulfate N.F. IX, avdp ozs.	—				—				—				
Sucrose Octaacetate, pounds	—				—				—				
Denatonium Benzoate, N.F., avdp ounces	—				—				—				
FORMULATION:	**190°**		**Anhydrous**		**190°**		**Anhydrous**		**190°**		**Anhydrous**		
	Min.	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	
SPECIFICATIONS:													
Specific gravity													
@ 15.56°C/15.56°C(60°F/60°F)	0.8228	0.8238	0.8028	0.8038	0.8182	0.8192	0.7964	0.7979	0.8150	0.8164	0.7934	0.7944	ASTM D-891
@ 20°C/20°C	0.8196	0.8207	0.7997	0.8007	0.8149	0.8161	0.7932	0.7948	0.8122	0.8132	0.7902	0.7912	
@ 25°C/25°C	0.8162	0.8172	0.7963	0.7972	0.8155	0.8126	0.7899	0.7914	0.8088	0.8098	0.7868	0.7879	
Acidity, wt/wt% as acetic acid	—	0.0050	—	0.0050	—	0.0050	—	0.0050	—	0.0025	—	0.0025	ASTM D-1613
Non-volatile matter, grams/100 ml	N/A		N/A		N/A		N/A		—	0.020	—	0.020	ASTM D-1353
Color, Pt-Co	—	20	—	20	—	10	—	10	—	10	—	10	ASTM D-1209
Water content, vol/vol %	—	—	—	0.10	—	—	—	0.10	—	—	—	0.10	ASTM D-1364
Odor	Typical				Typical				Typical				Organoleptic
TYPICAL PROPERTIES:													
Apparent Proof at 60°F	186.0		196.0		188.5		198.6		190.0		199.9		I.R.S. Gauging Manual
Composition wt/wt%													
Ethyl Alcohol	89.25		96.47		91.17		98.61		92.30		99.87		
Diethyl Phthalate	3.32		3.41		1.36		1.39		—		—		
tert-Butyl Alcohol	0.12		0.12		—		—		0.12		0.12		
Brucine Alkaloid	—		—		—		—		0.014		0.014		
Brucine Sulfate	—		—		—		—		—		—		
Sucrose Octaacetate	—		—		—		—		—		—		
Denatonium Benzoate	—		—		—		—		—		—		
Water	7.31		—		7.47		—		7.57		—		
Coefficient of expansion													
Per 1°C	0.0010		0.0011		0.0010		0.0011		0.0010		0.0011		
Per 1°F	0.0006		0.0006		0.0006		0.0006		0.0006		0.0006		
Flash point													ASTM D-56
Tag closed cup													
C°	14		13		16		13		16		13		
F°	58		55		60		55		61		56		
Tag open cup													ASTM D-1310
C°	18		16		18		16		18		16		
F°	65		60		65		60		65		60		
Pounds per gallon													
@ 60°F. per 27 CFR 212.115	6.857		6.677		6.819		6.642		6.795		6.611		
Shipping containers													
Tank cars		✓				✓				✓			
Tank trucks		✓				✓				✓			
Drums		✓				✓				✓			
Pails		✓				✓				✓			

Comments:

1. SDA 39, prepared by the addition of 9 pounds of sodium salicylate or salicylic acid U.S.P., 1.25 gallons fluid extract of quassia, N.F. VII and ⅛ gallon of tert-butyl alcohol to every 100 gallons alcohol, is an ATF authorized formulation. Because of very limited use it is not discussed in this book.
2. SDA 39A, prepared by the addition of 60 avdp. ounces of any of the following alkaloids or salts together with ⅛ gallon of tert-butyl alcohol: quinine N.F., quinine bisulfate N.F., quinine hydrochloride, U.S.P. cinchonidine, cinchonidine sulfate, N.F. IX to every 100 gallons alcohol, is an ATF authorized formulation. Because of very limited use it is not discussed in this book.
3. SDA 39D, prepared by the addition of one gallon bay oil N.F. and either 50 avdp ounces of quinine sulfate, U.S.P., 50 avdp ounces of quinine bisulfate, N.F., or 200 avdp. ounces sodium salicylate, U.S.P. to every 100 gallons alcohol, is an ATF authorized formulation. Because of very limited use it is not discussed in this book.
4. Determined by U.S.I.
5. This formula shall be used only in the manufacture of products which will be packaged in pressurized containers in which the liquid contents are in intimate contact with the propellant and from which the contents are not easily removable in liquid form.

(continued)

Table 6.37: (continued)

AUTHORIZED COMPOSITION:	SDA 40-2				SDA 40A				SDA 40B				SDA 40C [5]				Test Method
To every 100 gallons of alcohol add:																	
Diethyl Phthalate, gallons	—				—				—				—				
tert-Butyl Alcohol, gallons	⅛				⅛				⅛				3				
Brucine Alkaloid, avdp ounces	—				—				—				—				
Brucine Sulfate N.F. IX, avdp ozs.	1½				—				—				—				
Sucrose Octaacetate, pounds	—				1				—				—				
Denatonium Benzoate, N.F.; avdp ounces	—				—				1/16				—				
FORMULATION:	190°		Anhydrous		190°		Anhydrous		190°		Anhydrous		190°		Anhydrous		
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
SPECIFICATIONS:																	
Specific gravity																	
@ 15.56°C/15.56°C(60°F/60°F)	0.8154	0.8164	0.7934	0.7944	0.8158	0.8170	0.7939	0.7949	0.8152	0.8164	0.7934	0.7944	0.8148	0.8160	0.7829	0.7939	ASTM D-891
@ 20°C/20°C	0.8122	0.8132	0.7902	0.7912	0.8126	0.8138	0.7908	0.7918	0.8120	0.8132	0.7902	0.7912	0.8116	0.8128	0.7898	0.7908	
@ 25°C/25°C	0.8088	0.8098	0.7868	0.7879	0.8192	0.8104	0.7874	0.7884	0.8086	0.8098	0.7868	0.7879	0.8082	0.8094	0.7864	0.7874	
Acidity, wt/wt% as acetic acid	—	0.0050	—	0.0050	—	0.0025	—	0.0025	—	0.0025	—	0.0025	—	0.0025	—	0.0025	ASTM D-1613
Non-volatile matter, grams/100 ml	—	0.020	—	0.020	—	0.16	—	0.16	—	0.0025	—	0.0025	—	0.0025	—	0.0025	ASTM D-1353
Color, Pt-Co	—	10	—	10	—	10	—	10	—	10	—	10	—	10	—	10	ASTM D-1209
Water content, vol/vol %	—	—	—	0.10	—	—	—	0.10	—	—	—	0.10	—	—	—	0.10	ASTM D-1364
Odor	Typical				Typical				Typical				Typical				Organoleptic
TYPICAL PROPERTIES:																	
Apparent Proof at 60°F	190.0		199.9		189.7		199.7		190.0		199.9		190.2		200.1		I.R.S. Gauging Manual
Composition wt/wt%																	
Ethyl Alcohol	92.30		99.87		92.18		99.73		92.31		99.88		89.84		97.13		
Diethyl Phthalate	—		—		—		—		—		—		—		—		
tert-Butyl Alcohol	0.12		0.12		0.12		0.12		0.12		0.12		2.79		2.87		
Brucine Alkaloid	—		—		—				—		—		—		—		
Brucine Sulfate	0.014		0.014		—				—		—		—		—		
Sucrose Octaacetate	—		—		0.15		0.15		—		—		—		—		
Denatonium Benzoate	—		—		—				0.0006		0.0006		—		—		
Water	7.57		—		7.55		—		7.57		—		7.37		—		
Coefficient of expansion																	
Per 1°C	0.0010		0.0010		0.0011		0.0011		0.0010		0.0011		0.0010		0.0011		
Per 1°F	0.0006		0.0006		0.0006		0.0006		0.0006		0.0006		0.0006		0.0006		
Flash point																	ASTM D-56
Tag closed cup																	
C°	16		13		16		12		17		13		16		13		
F°	61		56		60		53		63		56		61		55		
Tag open cup																	ASTM D-1310
C°	18		16		18		17		18		16		18		16		
F°	65		60		65		62		65		60		65		60		
Pounds per gallon @ 60°F, per 27 CFR 212.115	6.795[4]		6.611[4]		6.798		6.613		6.794		6.610		6.788		6.609		
Shipping containers																	
Tank cars	√		√		√		√		√		√		√		√		
Tank trucks	√		√		√		√		√		√		√		√		
Drums	√		√		√		√		√		√		√		√		
Pails	√		√		√		√		√		√		√		√		

Comments:

1. SDA 39, prepared by the addition of 9 pounds of sodium salicylate or salicylic acid U.S.P., 1.25 gallons fluid extract of quassia, N.F. VII and ⅛ gallon of tert-butyl alcohol to every 100 gallons alcohol, is an ATF authorized formulation. Because of very limited use it is not discussed in this book.
2. SDA 39A, prepared by the addition of 60 avdp. ounces of any of the following alkaloids or salts together with ⅛ gallon of tert-butyl alcohol: quinine N.F., quinine bisulfate N.F., quinine hydrochloride, U.S.P. cinchonidine, cinchonidine sulfate, N.F. IX to every 100 gallons alcohol, is an ATF authorized formulation. Because of very limited use it is not discussed in this book.
3. SDA 39D, prepared by the addition of one gallon bay oil N.F. and either 50 avdp ounces of quinine sulfate, U.S.P., 50 avdp ounces of quinine bisulfate, N.F., or 200 avdp. ounces sodium salicylate, U.S.P. to every 100 gallons alcohol, is an ATF authorized formulation. Because of very limited use it is not discussed in this book.
4. Determined by U.S.I.
5. This formula shall be used only in the manufacture of products which will be packaged in pressurized containers in which the liquid contents are in intimate contact with the propellant and from which the contents are not easily removable in liquid form.

(continued)

Table 6.37: (continued)

AUTHORIZED COMPOSITION:

	SDA 45				SDA 46[4]				Test Method
To every 100 gallons of alcohol add:									
Refined Shellac, pounds	300				—				
Phenol, U.S.P., fl. ounces	—				25				
Methyl Salicylate, U.S.P., fl. ounces	—				4				
FORMULATION:	**190°**		**Anhydrous**		**190°**		**Anhydrous**		
	Minimum	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**	
SPECIFICATIONS:									
Specific gravity @ 15.56°C/15.56°C (60°F/60°F)	0.9036	0.9071	0.8868	0.8905	0.8166	0.8178	0.7946	0.7954	ASTM D-891
@ 20°C/20°C	0.9008	0.9043	0.8838	0.8875	0.8134	0.8146	0.7915	0.7925	
@ 25°C/25°C	0.8977	0.9012	0.8806	0.8844	0.8100	0.8112	0.7882	0.7892	
Acidity as acetic acid	N/A		N/A		—	0.02	—	0.02	ASTM D-1613
Non-volatile matter, grams/100 ml	N/A		N/A		—	N/A	—	N/A	ASTM D-1353
Color, Pt-Co	N/A		N/A		—	10	—	10	ASTM D-1209
Water content, vol/vol %	N/A		N/A		—	—	—	0.10	ASTM D-1364
Odor	Typical				Typical				Organoleptic
TYPICAL PROPERTIES:									
Apparent Proof at 60°F	127.0		141.0		189.3		199.4		I.R.S. Gauging Manual
Composition, wt/wt %									
Ethyl Alcohol	64.11		68.78		92.18		99.73		
Shellac	30.63		31.22		—		—		
Phenol			—		0.23		0.23		
Methyl Salicylate			—		0.04		0.04		
Water	5.26		—		7.55		—		
Coefficient of expansion									
Per 1°C	0.0009		0.0009		0.0011		0.0010		
Per 1°F	0.0005		0.0005		0.0006		0.0006		
Flash point									
Tag closed cup									ASTM D-56
C°					17		12		
F°					63		54		
Tag open cup									ASTM D-1310
C°	21		18		21		16		
F°	70		65		70		60		
Pounds per gallon @ 60°F. per 27 CFR 212.115	7.545		7.403		6.805		6.621		
Shipping containers									
Tank cars	No				No				
Tank trucks	No				No				
Drums	50 gallon open load drums				X				
Pails	No				X				

Comments:

1. SDA 42, prepared by addition of (1) 80 grams of potassium iodide, U.S.P. and 109 grams of red mercuric iodide, N.F.; (2) 95 grams thimerosal, N.F.; or (3) 76 grams of any of the following: phenyl mercuric nitrate, N.F.; phenyl mercuric chloride, N.F. IX or phenyl mercuric benzoate, to every 100 gallons alcohol is an ATF authorized formulation. Because of very limited use it is not discussed in this book.
2. SDA 44, prepared by the addition of 10 gallons of n-butyl alcohol is an ATF authorized formulation. Because of very limited use it is not discussed in this book. Specific information may be obtained by contacting any U.S.I. sales office.
3. This formula may be used only by institutions and organizations which are of a semipublic character and engaged in charitable work.
4. This formula may be used only by organizations or institutions which are of a semipublic character and engaged in charitable work.

Table 6.38: Authorized Denaturants for SDA 38B *(30)*

The properties of SDA 38B are as diverse as are the denaturants used in this formula and the products formulated with it.

The authorized composition of SDA 38B requires that 10 pounds of any one, or a total of 10 pounds of two or more, of the oils and substances listed below are to be added to 100 gallons of alcohol. The authorized denaturants include:

Anethole, U.S.P.
Anise oil, U.S.P.
Bay oil (myrcia oil), N.F.
Benzaldehyde, N.F.
Bergamot oil, N.F.
Bitter Almond oil, N.F.
Camphor, U.S.P.
Cedar leaf oil, U.S.P. XIII
Chlorothymol, N.F.
Cinnamic Aldehyde, N.F. IX
Cinnamon oil (Cassia oil), U.S.P.
Citronella oil, Natural
Clove oil, U.S.P.
Coal tar, U.S.P.
Eucalyptol, U.S.P.
Eucalyptus oil, N.F.
Eugenol, U.S.P.
Guaiacol, N.F.
Lavender oil, N.F.
Menthol, U.S.P.
Mustard oil, volatile (allyl isothiocyanate) U.S.P.
Peppermint oil, U.S.P.
Phenol, U.S.P.
Phenyl salicylate (Salol), N.F.
Pine oil, N.F.
Pine needle oil, dwarf, N.F.
Rosemary oil, N.F.
Spearmint oil, N.F.
Spearmint oil, terpeneless
Spike lavender oil, natural
Storax, U.S.P.
Thyme oil, N.F.
Thymol, N.F.
Tolu balsam, U.S.P.
Turpentine oil, N.F.
Wintergreen oil (methyl salicylate) U.S.P.

Because of the virtually infinite number of authorized denaturants and denaturant combinations, only a typical set of properties for SDA 38B have been listed

Table 6.39: Denaturants Authorized for Completely Denatured Alcohol (CDA) and Specially Denatured Alcohol (SDA) *(30)*

DENATURANT	USED IN
Acetaldehyde	S.D.A. 29
Acetone N.F.	S.D.A. 23A; 23-H
Acetaldol	C.D.A. 18
Almond oil, bitter N.F.	S.D.A. 38-B
Ammonia, aqueous	S.D.A. 36
Anethole U.S.P.	S.D.A. 38-B
Anise oil U.S.P.	S.D.A. 38-B
Bay oil (myrcia oil) N.F.	S.D.A. 23-F; 38-B; 39-D
Benzaldehyde N.F.	S.D.A. 38-B
Benzene	S.D.A. 2-B; 2-C; 12-A
Bergamot oil N.F.	S.D.A. 23-F; 38-B
Bone oil (Dipple's oil)	S.D.A. 17
Boric acid U.S.P.	S.D.A. 38-F
Brucine alkaloid	S.D.A. 40
Brucine sulfate N.F. IX	S.D.A. 40
n-Butyl alcohol	S.D.A. 44
tert-Butyl alcohol	S.D.A. 39, 39-A; 39-B; 40; 40-A; 40-B; 40-C
Camphor U.S.P.	S.D.A. 27; 27-A; 38-B
Caustic soda, liquid	S.D.A. 36
Cedar leaf oil U.S.P. XIII	S.D.A. 38-B
Chloroform	S.D.A. 20
Chlorothymol N.F.	S.D.A. 38-B; 38-F
Cinchonidine	S.D.A. 39-A
Cinchonidine sulfate N.F. IX	S.D.A. 39-A
Cinnamic aldehyde (cinnamaldehyde) N.F. IX	S.D.A. 38-B
Cinnamon oil (cassia oil) U.S.P.	S.D.A. 38-B
Citronella oil, natural	S.D.A. 38-B
Clove oil U.S.P.	S.D.A. 27-A; 38-B
Coal tar U.S.P.	S.D.A. 38-B
Denatonium benzoate N.F. (Bitrex)	S.D.A. 1; 40-B
Diethyl phthalate	S.D.A. 39-B; 39-C
Ethyl acetate	S.D.A. 29; 35; 35-A
Ethyl ether	S.D.A. 13-A; 19; 32
Eucalyptol U.S.P.	S.D.A. 37; 38-B
Eucalyptus oil N.F.	S.D.A. 38-B
Eugenol U.S.P.	S.D.A. 38-B
Formaldehyde solution U.S.P.	S.D.A. 22; 38-C; 38-D
Gasoline	C.D.A. 18; 19; 20; S.D.A. 28-A
Glycerol U.S.P.	S.D.A. 31-A
Guaiacol N.F.	S.D.A. 38-B
Iodine U.S.P.	S.D.A. 25; 25-A
Kerosene	C.D.A. 18; 19; 20
Lavender oil U.S.P.	S.D.A. 27-B; 38-B
Menthol U.S.P.	S.D.A. 37; 38-B; 38-C; 38-D; 38-F
Mercuric iodide, red N.F.	S.D.A. 42
Methyl alcohol	S.D.A. 3-A; 30
Methylene blue N.F.	S.D.A. 4
Methyl isobutyl ketone	C.D.A. 18; 19; S.D.A. 1; S.D.A. 23-H
Methyl normal-butyl ketone	C.D.A. 18; 19; S.D.A. 1
Methyl violet (methylrosaniline chloride)	S.D.A. 33
Methyl violet (methylrosaniline chloride) U.S.P.	S.D.A. 33
Mustard oil, volatile (allyl isothiocyanate) U.S.P. XII	S.D.A. 38-B
Nicotine solution	S.D.A. 4
Peppermint oil U.S.P.	S.D.A. 38-B
Phenol U.S.P.	S.D.A. 38-B; 46
Phenyl mercuric benzoate	S.D.A. 42
Phenyl mercuric chloride N.F. IX	S.D.A. 42
Phenyl mercuric nitrate N.F.	S.D.A. 42
Phenyl salicylate (salol) N.F.	S.D.A. 38-B
Pine needle oil, dwarf N.F.	S.D.A. 38-B
Pine oil N.F.	S.D.A. 38-B
Pine tar N.F.	S.D.A. 3-B
Polysorbate 80 U.S.P.	S.D.A. 38-F
Potassium iodide U.S.P.	S.D.A. 25; 25-A; 42
Pyridine bases	S.D.A. 6-B
Pyronate	C.D.A. 18
Quassia, fluid extract of N.F. VII	S.D.A. 39
Quassin	S.D.A. 40
Quinine N.F.	S.D.A. 39-A
Quinine bisulfate N.F.	S.D.A. 39-A; 39-D
Quinine hydrochloride U.S.P.	S.D.A. 39-A
Quinine sulfate U.S.P.	S.D.A. 39-D
Resorcin U.S.P.	S.D.A. 23-F
Rosemary oil N.F.	S.D.A. 27; 38-B
Rubber hydrocarbon solvent	S.D.A. 2-B; 2-C
Salicylic acid U.S.P.	S.D.A. 23-F; 39
Shellac (refined)	S.D.A. 45
Soap, hard N.F.	S.D.A. 31-A
Soap, medicinal soft U.S.P.	S.D.A. 27-B
Sodium iodide U.S.P.	S.D.A. 25; 25-A
Sodium, metallic	S.D.A. 2-C
Sodium salicylate U.S.P.	S.D.A. 39; 39-D
Spearmint oil N.F.	S.D.A. 38-B
Spearmint oil, terpeneless	S.D.A. 38-B
Spike lavender oil, natural	S.D.A. 38-B
Storax U.S.P.	S.D.A. 38-B
Sucrose octa-acetate	S.D.A. 40-A
Thimerosal, N.F.	S.D.A. 42
Thyme oil N.F.	S.D.A. 38-B
Thymol N.F.	S.D.A. 37; 38-B; 38-F
Tolu balsam U.S.P.	S.D.A. 38-B
Toluene	S.D.A. 2-B; 2-C; 12-A
Turpentine oil N.F.	S.D.A. 38-B
Vinegar	S.D.A. 18
Wintergreen (Methyl salicylate) U.S.P.	S.D.A. 38-B; 46

Primary Denaturants Authorized for Denatured Spirits—Title 27 Code of Federal Regulations 212.110

Table 6.40: Uses of Specially Denatured Alcohol* *(30)*

PRODUCT OR PROCESS	CODE NO.	FORMULAS AUTHORIZED
Acetaldehyde	551	1, 2-B, 29
Acetic acid	512	1, 2-B, 29, 35-A
Adhesives and binders	036	1, 3-A, 12-A, 23-A, 30
Aldehydes, miscellaneous	552	1, 2-B, 29
Alkaloids (processing)	344	1, 2-B, 2-C, 3-A, 12-A, 13-A, 17, 23-A, 30, 32, 35-A
Animal feed supplement	910	35-A
Antibiotics (processing)	343	1, 2-B, 3-A, 12-A, 13-A, 23-A, 30, 32, 35-A
Antifreeze, proprietary	760	1
Antiseptic, bathing solution (restricted)	220	46
Antiseptic solutions, U.S.P. or N.F.	244	23-A, 37, 38-B, 38-F
Bath preparations	142	1, 3-A, 3-B, 23-A, 30, 36, 38-B, 39-B, 39-C, 40, 40-A, 40-B, 40-C
Bay rum	112	23-A, 37, 38-B, 39, 39-B, 39-D, 40, 40-A, 40-B, 40-C
Biocides, miscellaneous	410	1, 3-A, 3-B, 23-A, 23-H, 27-A, 27-B, 30, 37, 38-B, 39B, 40, 40-A, 40-B, 40-C
Blood and blood products (processing)	345	1, 3-A, 12-A, 13-A, 23-A, 30
Brake fluids	720	1, 3-A
Candy glazes	015	13-A, 23-A, 35, 35-A, 45
Cellulose coatings	011	1, 23-A, 30
Cellulose compounds (dehydration)	311	1, 2-B, 3-A, 32
Cellulose intermediates	034	1, 3-A, 12-A, 13-A, 19, 23-A, 32
Chemicals (miscellaneous)	579	1, 2-B, 2-C, 3-A, 6-B, 12-A, 13-A, 17, 20, 29, 30, 32, 36
Cleaning solutions	450	1, 3-A, 23-A, 23-H, 30, 36, 39-B, 40, 40A, 40-B, 40-C
Coatings, miscellaneous	016	1, 23-A
Collodions, industrial	034	1, 3-A, 12-A, 13-A, 19, 23-A, 32
Collodions, U.S.P. or N.F.	241	13-A, 19, 32
Colognes	122	38-B, 39, 39-A, 39-B, 39-C, 40, 40-A, 40-B, 40-C
Crude drugs (processing)	341	1, 2-B, 3-A, 23-A, 30
Cutting oils	730	1, 3-A, 12-A
Dehydration products, miscellaneous	315	1, 2-B, 3-A
Dentifrices	131	31-A, 37, 38-B, 38-C, 38-D
Deodorants (body)	114	23-A, 38-B, 39-B, 39-C, 40, 40-A, 40-B, 40-C
Detergents, household	450	1, 3-A, 23-A, 23-H, 30, 36, 39-B, 40, 40-A, 40-B, 40-C
Detergents, industrial	440	1, 3-A, 23-A, 30
Detonators	574	1, 6-B
Disinfectants	410	1, 3-A, 3-B, 23-A, 23-H, 27-A, 27-B, 30, 37, 38-B, 39-B, 40, 40-A, 40-B, 40-C
Drugs and medicinal chemicals	575	1, 2-B, 2-C, 3-A, 6-B, 12-A, 13-A, 17, 29, 30, 32
Drugs, miscellaneous (processing)	349	1, 2-B, 3-A, 13-A, 23-A, 30, 35-A, 38-B
Duplicating fluids	485	1, 3-A, 30
Dyes and intermediates	540	1, 2-B, 2-C, 3-A, 12-A, 29, 36
Dyes and intermediates (processing)	351	1, 2-B, 3-A, 12-A
Dye solutions, miscellaneous	482	1, 3-A, 23-A, 30, 39-C, 40, 40-A, 40-B, 40-C
Embalming fluids, etc.	420	1, 3-A, 22, 23-A
Esters, ethyl (miscellaneous)	523	1, 2-B, 2-C, 3-A, 6-B, 12-A, 13-A, 17, 29, 32, 35-A
Ether, ethyl	561	1, 2-B, 13-A, 29, 32
Ethers, miscellaneous	562	1, 2-B, 13-A, 29, 32
Ethyl acetate	521	1, 2-B, 29, 35-A
Ethylamines	530	1, 2-B, 2-C, 3-A, 12-A, 29, 36
Ethyl chloride	522	1, 2-B, 29, 32
Ethylene dibromide	571	1, 2-B, 29, 32
Ethylene gas	572	1, 2-B, 29, 32
Explosives	033	1, 2-B, 3-A
External pharmaceuticals (not U.S.P. or N.F.)	210	23-A, 23-F, 23-H, 27-A, 27-B, 36, 37, 38-B, 38-F, 39-B, 40, 40-A, 40-B, 40-C
External pharmaceuticals, miscellaneous (U.S.P. or N.F.)	249	23-A, 25, 25-A, 38-B
Fluid uses, miscellaneous	750	1, 3-A, 23-A, 30
Food products, miscellaneous (processing)	332	1, 2-B, 3-A, 13-A, 23-A, 30, 32, 35-A
Fuel uses, miscellaneous	630	1, 3-A, 28-A
Fuels, airplane and supplementary	612	1, 3-A, 28-A
Fuels, automobile and supplementary	611	1, 3-A, 28-A
Fuels, proprietary heating	620	1, 3-A, 28-A
Fuels, rocket and jet	613	1, 3-A, 28-A
Fungicides	410	1, 3-A, 3-B, 23-A, 23-H, 27-A, 27-B, 30, 37, 38-B, 39-B, 40, 40-A, 40-B, 40-C
Glandular products (processing)	342	1, 2-B, 3-A, 12-A, 13-A, 23-A, 30, 32, 35-A
Hair and scalp preparations	111	3-B, 23-A, 23-F, 23-H, 37, 38-B, 39, 39-A, 39-B, 39-C, 39-D, 40, 40-A, 40-B, 40-C
Hormones (processing)	342	1, 2-B, 3-A, 12-A, 13-A, 23-A, 30, 32, 35-A

*Other products or processes may be authorized by the Director of the Bureau of Alcohol, Tobacco and Firearms, Department of the Treasury, Washington, D.C. Uses of Specially Denatured Alcohol—27 CFR 212.105

(continued)